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ABSTRACT

This document presents an abbreviated report of the evaluation and impact assessment of 11 experimental projects funded by the National Science Foundation (NSF) in FY 1974 and FY 1975 to increase the number of women engaged in science-related careers. The report includes a description of the evaluation methodology used, project summaries, program observations and comparative analysis. A brief project description, along with conclusions and recommendations, is given for each project. Four appendices are included: (1) Alternative Interventions; (2) Film Bibliography; (3) Selected Bibliography; and (4) Selected Annotated Bibliography. (MA)

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Final Technical Report
Contract #NSF-C1053

AN IMPACT ANALYSIS OF SPONSORED PROJECTS TO INCREASE THE PARTICIPATION OF WOMEN IN CAREERS IN SCIENCE AND TECHNOLOGY
(abbreviated version with selected appendices)

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1978

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EXECUTIVE SUMMARY

This report contains the evaluation and impact assessment of 11 experimental projects funded by the National Science Foundation in FY 1974 and FY 1975 in an attempt to increase the number of women engaging in science-related careers. The report assesses both the individual projects and the collection of projects as a whole. The projects were conducted at: University of Kansas, Policy Studies in Education, Queensborough College, the University of Missouri at Kansas City, Rosemont College, Massachusetts Institute of Technology, two at Michigan Technological University, American College Testing and the University of Oklahoma. An addendum of the report will be prepared for Mary Baldwin College, the only project not yet completed.

Chapter I describes the evaluation methodology used by the Denver Research Institute. The methodology included an assessment of project documents, site visits, a participant impact survey, and the utilization of an evaluation form completed by both DRI and the project directors. The chapter also describes the difficulty in conducting the evaluation because of the many different internal evaluation instruments developed and used by the projects. In addition, the design of some of the projects for internal evaluation was not adequate to permit definitive conclusions.

Chapter II of the full report contains a synopsis of each of the projects. Each synopsis contains a description of the project as it was originally conceived, the project as it was actually implemented, obstacles to project implementation, a description of project personnel including role models, a report of the primary outcomes as described by project documents, by the data obtained by the participant impact survey, and from observations derived from the site visits. Each synopsis also contains a section on the secondary impacts of the project, the materials developed as the project product(s), and the dissemination strategies employed by project personnel. It also contains a section on project costs, including the estimated cost to reuse the curriculum products in other settings, and a section on recommendations and conclusions of the evaluation team. Only the project descriptions and conclusions are given in the executive summary document.

The third chapter contains observations derived from the comparative assessments of the experimental projects with respect to their effect on professional careers, general career recommendations, reentry programs, and general administration recommendations regarding future program decisions.

The report contains several recommendations. Since the data did not provide a basis for conclusions, the evaluation team employed a "preponderance of evidence" approach to estimating the success of the projects. These estimates could not be used to indicate cause-

effect relationships, so commonalities between the projects were proposed as hypotheses to be tested. They are summarized under three headings:

Hypotheses regarding programs to encourage the participation of women in science careers are concerned with:

1. Concentrating on women already interested in science
2. Concentrating on women with above average motivation and ability
3. Using workshops as a format for the treatment
4. Encouraging participant interaction
5. Using sustained periods of contact
6. Using role models in as many situations as possible
7. Using "hands-on" experiences
8. Segregating some activities by sex
9. Removing institutional barriers to participation
10. Aiming efforts at significant others in the community

A list of hypotheses or recommendations regarding general career education would be very long. However, two concepts are delineated as most relevant to science careers. These are:

1. Separating special science programs from general career education
2. Emphasizing the importance of mathematics preparation

The hypotheses regarding reentry programs for mature women are related to:

1. Concentrating on underemployed women
2. Considering the employment prospects in the locale
3. Funding projects to update skills
4. Enhancing the job readiness skills of the participants
5. Increasing the assistantships for mature women continuing their education

The general administrative recommendations for use by NSF are:

1. Improving the quality of the research, including
   a. more selectivity in funding
   b. providing technical assistance to project directors and
   c. using standardized evaluation tools

2. Coordinating intergovernmental and interagency activities

3. Continuing experimental activities by NSF

4. Including specific programs for minority women

5. Attending to the continuity/institutional problems of the funded efforts

6. Disseminating the developed materials

7. Systematic study of the effects of:
   aggregating minorities/women;
   the attitudes of the male science establishment and
   the effect of "significant others" in a real time situation

The appendices contain a list of alternative interventions. They begin with a list of psychological, sociological and institutional barriers to the participation of women in science-related careers. Some assumptions are delineated, and different kinds of interventions or treatments that might be used are proposed. Each of the suggested interventions is categorized by educational level; e.g., elementary school, high school, college, graduate school, reentry and post-employment programs. The appendices also contain a sample of the evaluation collection sheet used by DRI, a sample of the participant impact survey and the cover letter accompanying it; a bibliography of selected programs similar to the NSF projects, a film bibliography, a selected bibliography of the literature, and a selected annotated bibliography of the literature. These are not included in the executive summary document.

CHAPTER I
INTRODUCTION

According to the NSF Bulletin (E-74-1) announcing the educational programs for the fiscal year 1974, among the program goals were "increasing the flow of women into careers in science" and "discovering effective mechanisms for increasing participation of women in scientific careers."

The National Science Foundation funded eight experimental projects in 1974 and four in 1975 in an effort to meet these objectives. Projects had budgets ranging from $20,000 to about $100,000. The educational level of the women they addressed ranged from the secondary level to college, and postgraduate/reentry age groups. Each approach was somewhat unique. This report contains an evaluation of each of these projects.

The program strategy chosen by NSF was to fund a small number of disparate projects, to assess their effectiveness, and to utilize the results in future planning. While this is a viable and cost-effective approach, especially in areas where little is known about effective programs or mechanisms, it presents many difficulties for the evaluators of those programs.

Because of the desire on the part of NSF to have feedback as quickly as possible upon which to base their future program decisions, most of the projects were funded for a one-year period and were required to have an "internal evaluation" component. This "internal evaluation" most frequently translated into an experimental/control group design. The most reliable measure of effectiveness is an actual increase in the number of women pursuing science-related careers. However, this dependent measure is not viable for a one-year project since the participant's appearance in the labor force may be four to ten years in the future. Therefore, the majority of the projects choose some measure of attitude or knowledge change over the year period, or an interim behavioral measure, e.g., science course, declared major, etc.* Further, no valid instrument exists designed to reflect changes in career options, awareness of career potential and/or career plans. Consequently, the majority of the project directors were forced to design their own evaluation instruments or attitude questionnaires. This situation was disadvantageous for both the project directors and the evaluators. First, validating a questionnaire and assessing its reliability is a complex, arduous, and expensive

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*Several of the projects are conducting long-term tracking at their own expense.

undertaking that requires considerable sophistication in the rather narrow area of testing. Second, with a pre- and post-test design even the most reliable and valid attitude measures frequently fail to reflect changes in attitudes because of "sleeper" effects or other variables. Even then, reported attitude changes may not be translated into behavioral changes. Third, many different and unvalidated self report instruments were used as dependent measures. For all these reasons, the project evaluations or experimental outcomes cannot be considered definitive.

Another factor limiting the Denver Research Institute evaluation effort was frequently a less than adequate design and analysis of the experimental intervention. Almost without exception the project directors appeared very committed to and well versed in women's problems and science subject matter. Most, however, did not have extensive experience in project evaluation and/or experimental procedures. Given the desire of NSF to produce "hard results," one possible remedy to this situation may have been for the Foundation to provide guidelines for data collection to the project directors or to provide technical assistance in their evaluation efforts.

The task of Denver Research Institute, then, has been to compare "apples and oranges," e.g., different experimental treatments measured by idiosyncratic instruments which have no reported reliability/validity data. Since the typical project did not result in statistically significant results, the evaluation team had to resort to more subjective judgment than proposed. This judgment has covered the outcomes, and impacts, project personnel and processes, and project materials.

Methodology

The information for the evaluation effort was collected several different ways. Copies of all the documents produced by project personnel were studied. Site visits were made to most of the projects. During the site visit, the evaluation team interviewed available project personnel, participants, role models and consultants. After the site visit, the team completed the form outline given in Appendix B. The form was slightly modified and sent to project directors to complete in order to verify the evaluation teams' perceptions and/or to correct any erroneous conclusions, as well as to provide data the team may have omitted.

In an attempt to "standardize" the outcome measures of the projects, the evaluation team sent out a short independent "participant impact survey" to the project participants whose names were provided

CHAPTER II
PROJECT SUMMARIES

A. "Increasing Participation of Qualified Women in Traditionally Male Science Careers"
University of Kansas, Lawrence, Kansas 66045
Project Director: Walter S. Smith, Associate Dean of Women
Project Amount: $12,745
Educational Level: Secondary

Proposed Project*

The project was proposed to test the hypothesis that if college freshman women who possess the necessary ability become aware of the barriers to participating in science-related careers and receive parental and peer support in their effort to overcome the barriers, then these women (the experimental group) will enter traditionally male science careers in a significantly larger proportion than a comparison (control) group which does not receive special treatment.

The subjects for this project were to be drawn from women seeking admission to the University of Kansas who possessed high science and mathematics ability, have taken high school science and mathematics courses adequate to pursue a college science major, but do not aspire to a science career (defined as one in which males constitute more than 80 percent of the practitioners). Two groups were to be identified: the first, seeking admission in Fall 1974 (the comparison group) and the second, seeking admission in Fall 1975 (the experimental group). Each group was to have 100-150 members.

Members of the experimental group and their parents were to be invited to separate, concurrent workshops in the Spring of 1975. The comparison group would not have access to the workshops, the home study course, or to any other aspects of the instructional treatments. Both groups were to receive the same post-tests, although the comparison group would receive the post-tests one year earlier than the experimental group.

The purpose of the student workshop was (1) to identify for each student aspects of her own self concept which may inhibit her choice of a traditionally male science career, (2) to work in group planning sessions to understand ways in which these inhibitions have

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*Many of the project descriptions were taken in part from "Brief Descriptions of 28 Studies and Experimental Projects Related to Careers in Science for Women Funded by the National Science Foundation for Fiscal Years 1974 and 1975." National Science Foundation, August 1975.

affected her career choice and to broaden the range of possible career choices for each participant, and (3) to show the students how they can use the University's resources to pursue a traditionally male science career. At the same time, but in a separate workshop, the parents would be introduced to possible realistic careers and life patterns for women and be given an opportunitity to explore new career aspirations for their daughters.

Following the workshop, the student participants were to pursue a home course of study which would build on the workshop's objectives. This course of study, to be completed before the start of their first semester in college, would yield college credit.

The participants were to be encouraged to live in the same residence hall during their first year in college, so that they would be able easily to meet formally and informally to discuss problems, provide mutual support, and continue to make plans to overcome personal and external barriers to their pursuit of traditionally male science careers.

The two groups were to be compared at the start and end of their freshman years. Comparisons would be made in (1) career choice, (2) awareness of barriers which have impeded women's entry into traditionally male professions, and (3) success in personally removing barriers from entry into traditionally male science careers (e.g., expectation of personal career achievement, independence of spouse, and willingness to assume responsibility). Using the same testing procedures, the two groups will again be compared five and ten years after the start of their freshman year.

An additional result of this project was expected to be the development of an exportable package of instruction which could be used by other universities or by the high schools to increase the science career aspirations of their women students.

Conclusions and Recommendations

The workshops were conducted as planned, and appeared to be successful in that more women in the experimental group stated they were planning to pursue science-related careers than in the control group from the year before (48.6 percent vs. 26.5 percent). These results, however, cannot be considered conclusive because the second comparison group, those who were invited to the workshop but who did not attend, also reported a similarly high preference for science careers. In addition, the respondents to the participant impact survey reported the highest proportion choosing science as a career and currently taking a math or science course. Because the response to the workshops was generally positive, and because no evidence of any negative effects were found, the workshops were judged to be probably successful.

No conclusions can be reached about the "home study" course, because of the small number completing it. However, the little data available suggest that it is interesting and well prepared. The evaluation team would like to see it utilized and assessed. The peer support groups may be more appropriate for upper class women and might meet with better success if structured around a task, e.g., a tutorial program, a special course, since these were not frequent or well attended.

The participants judged the role models to be the most effective component of the workshops. The evaluation team feels that the project director, a male, was also viewed as a positive role model in that he is supportive of womens' careers.

The workshop materials and home course of studies are designed as a self exploration exercise and are complete and in usable form. The materials have a widespread applicability, for a wide range of age groups, career preferences and for both sexes and could be used in conjunction with a variety of other materials. Consequently, the evaluation team feels that the limited distribution should be expanded into formal dissemination activities.

Although the attitude of the parents toward the workshop was not evaluated directly, interviews with the participants led the evaluation team to believe that strategies including parents in the career planning process may be very fruitful and should be explored further.

Although the emphasis on perceived barriers was dropped because of the reaction of the women, the perceived barriers were recorded. When the control group was asked to list the barriers, the lack of educational and employment opportunities in science was the most frequently mentioned. However, when ranking a list of barriers, the difficulty of combining a science career with a family was the most prominent.

B. "Science-Oriented Career Development Workshops for High School Girls"
Policy Studies in Education, New York, New York 10017
(Grant originally made to Institute for Educational Development)
Project Director: Virginia S. Newton
Project Amount: $65,193
Educational Level: Secondary

Proposed Project

In this project a series of career development workshops were to be designed. The workshops were to be developed to serve as a model for use by schools as a whole package or as separate units for natural science, mathematics, or social science classes. They were to include two life-style workshops, three career-cluster workshops relating to three broad areas of science, and one integrating workshop. Five of these would be pilot tested in the first semester of the 1974-75 school year in one school; all would be field tested in the second semester in the first school and in a contrasting second school.

Project personnel were to include staff from Policy Studies in Education and Catalyst, a national nonprofit organization founded to expand career opportunities for college-educated women. They were to work with associates from selected schools. Female and male workshop speakers would serve as role models. An advisory committee was to function as a resource concerning specific content for the career-cluster workshops.

The girls who participate were to be compared with similarly selected nonparticipant groups with 60 persons in each group. They were to be at or above grade level and possessing the potential for entering scientific careers. Only women were to be included in the experimental groups, but men and women were to be contained in the control groups. Pre- and post-instruments would be used to assess initial levels and changes in the direction of the predicted student outcomes. Formative evaluation techniques, used throughout the project, were to furnish information on the reactions of the student participants, the school associates, and the workshop speakers.

The major comparisons in the data analysis were to involve participant vs. comparison groups; grade 10 vs. grade 11; non-coeducational vs. coeducational school settings; and socioeconomic/ethnic grouping. These major variables were to be examined in relation to such variables as career orientation, knowledge of scientific fields, college and career preferences, and sex-role stereotyping.

The project was expected to result in a full description of the model for use in other schools, a teacher's guide, a compendium

of resources, separate guides for the individual workshops, career guidance materials, and a videotape to illustrate the workshop process.

Conclusions and Recommendations

Although no firm conclusions can be reached because of the loss of a high ability sample, several planned control groups and the design of the internal evaluation instrument, it must be concluded that this approach was probably not successful and should not be replicated until it is modified. That is, the final report noted that while educational and occupational aspirations may have increased, the range of nontraditional career choices, including science, that the participants were considering, decreased.

The role models were reported to be the most effective component of the project. The project resulted in several interesting observations about the nature of effective role models. The participants reported that they were more influenced by the role models they could identify with; the younger, college and graduate students rather than the accomplished professionals. It was also reported that participant interaction with the role models, in a small group, rather than formal presentation, was the most successful mode of conveying information. It was also observed that the job which the role model held was unimportant; her enthusiasm for her job was the critical component. The younger women were more interested in whether it was possible to combine a career with a family and/or alternative life-styles than the content of a particular job. Finally, the participants reported a preference for an all-female environment. Therefore, we recommend utilizing a wide range of role models in an informal, all-female, small group setting.

This project documented the problems that may be encountered in attempting to conduct a project within the public school system. Since all of the projects attempting this strategy met some obstacles, we recommend careful thought and planning prior to implementation.

The materials for the project are complete and could be used independently or in conjunction with other materials. Little dissemination of the materials has occurred.

C. "Development of Educational Materials to Recruit Women Into Scientific Careers"
Queensborough Community College, Bayside, New York 11364
Project Director: Dinah L. Moche, Department of Physics
Project Amount: $20,129
Educational Level: Secondary and College

Proposed Project

Multimedia packets (including slides, written materials, and an audio cassette) were to be prepared on five living women scientists, representing a range of ages and diverse fields of expertise. The packets were to concentrate on explaining the research work the women are doing but would include a small addition of personal data. Each woman was to be personally interviewed by the Project Director.

For evaluation, five selected educators in different educational positions would administer a questionnaire before and immediately after the use of the packets to measure their impact on the cognitive and affective behavior of students regarding careers in physical science.

Conclusions and Recommendations

The project exceeded its contractual agreements (six interviews rather than five) in the allotted time period. The package contained bibliographic materials of six outstanding women scientists, not representing a continuum of achievement. Different age and ethnic groups, as well as life-styles are portrayed. The packet is transportable, convenient, inexpensive and of average technical quality.

The effectiveness of the package in changing attitudes cannot be assessed from the design of the internal evaluation and the data analysis. Our impression is that the length is not sufficient to alter existing career plans. However, the packet would appear to be easily combined with any other program, and applicable to a wide range of age groups from junior high to reentry groups.

Dissemination activities have been successfully conducted, by the American Association of Physics Teachers and the National Science Teachers Association.

D. "Preparation of Ancillary Materials for, and Formative Evaluation of, a Film on Women in Engineering"
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139
Project Director: John T. Fitch, Center for Advanced Engineering Study
Project Amount: $35,919
Educational Level: Secondary and College

Proposed Project

The Center for Advanced Engineering Study at MIT has completed the first version of a film ("Women in Engineering"), which is designed to motivate young women in high school and the early years of college to consider careers in engineering. Produced in cinema verite style, it presents engineering students and professional women engineers in school, at work, and at home. Showing these women in discussion groups, in the classroom, and on the job, it was hoped, would provide an understanding of engineering, dispel some of the myths and stereotypes surrounding engineering, and provide female role models. NSF funds were to be used for the preparation of guides for students and educators, for a formative evaluation of the effectiveness of the film and the ancillary materials, and for modifications of the materials based on the findings of the evaluation.

An important component of the work was to be a two-stage evaluation of the proposed materials. Two major purposes of the evaluation work were to be: (1) to provide feedback to the filmmakers and writers that will facilitate and strengthen the development of the proposed materials; and (2) to document the effectiveness of the materials when used in a variety of settings.

A number of questions were posed to serve as a framework for the evaluation study:

1. To what extent does participation in the proposed project broaden students' understanding of the field of engineering--in terms of its function in society and the range of career opportunities?

2. What impact does the film, the ancillary materials, and related classroom discussions have on students' attitudes and concerns both toward engineering as a career and toward the role of professional women engineers, in particular?

3. Do students develop a clearer understanding of the skills and interests needed to enter the field?

4. Are students better able to analyze their own abilities and interests in relation to pursuing a career in engineering as a result of having participated in this program? Do they demonstrate a clearer understanding of how they might pursue their interests in this field?

To address these questions, MIT planned to employ several complementary clinical and survey techniques to gather relevant data. Interviews with students and teachers were to be conducted using a semi-structured format and open-ended questions. Classroom observations were also planned. Data collected by these methods were to be used to illuminate quantitative findings gathered by means of written questionnaires. The questionnaires were to be primarily multiple (forced) choice in format, although they would also include a number of open-ended questions. In the first stage, trial versions of the film, student leaflet and educator's handbook would be tested locally in a small sample of classrooms (approximately five). During this period the evaluation instruments were to be developed and pretested. A questionnaire was to be administered to students in each of the classrooms; several students in each classroom and their teachers were to be interviewed; and classroom observations would be made during the viewing and discussion periods.

Conclusions and Recommendations

The film and booklet offered concrete usable information about the field of engineering, and the requirements to enter the profession. MIT reported that more students were undecided about careers in engineering after the film and class discussions than before and more students reported they were not interested in engineering careers. The outcome, then, was slightly positive. However, because of the evaluation design, no definitive conclusions can be reached. The evidence seems to indicate that while the materials are good, they are not sufficient in and of themselves to alter existing preferences. The materials did, however, increase the accuracy of perceptions about the occupation and its requirements.

The materials are probably most appropriate for eleventh graders and tenth graders of high ability, since more twelfth

graders reported not being interested in the content. They can be easily adapted for a single class period in any subjects related to engineering or career education. Since the impression made on males by the film was not discussed, the film might be most appropriate for career education classes, rather than science or math classes. The dissemination activities conducted by MIT have been extensive and fruitful.

The final report by MIT indicated that the female participants expressed a great deal of interest in combining a career with a family. In fact, it is interesting to note that a greater percentage thought that engineering was appropriate for for women than thought that combining a career and family was appropriate for women.

Recognizing the extremely small amount of money allocated to the internal project evaluation, the evaluation team feels that development of a standardized measurement instrument by NSF would be especially useful to these types of projects. The approach of congruent validity used in this study (use of different instruments conceptually related to arrive at a conclusion) provides a basis only for a more general interpretation of results, and the post questionnaire linking "before I saw the film" and "after I saw the film" likely confounded the results.

The evaluation team would prefer to see a greater number of males included in the evaluation of such projects, so the differences could be conclusively analyzed. Specifically, although males were included in both the experimental and control groups, no differences by sex are reported. It is assumed that either (a) no differences were present, (b) the differences were not analyzed or (c) the number of males in the sample was too small to reliably show any difference.

E. "Increasing Women in the Sciences Through an Experimental Mathematics Project"
University of Missouri, Kansas City (UMKC)
Principal Investigator: Dr. Carolyn MacDonald
Project Amount: $27,664
Educational Level: College
Project No.: GY 11326

Proposed Project

Thirty freshman women entering UMKC in the fall of 1974 were to be selected for participation in a project designed to increase the number of women in the sciences by reinforcing their mathematical skills. Students were to be selected for their potential ability to study successfully in the sciences. Selection would be on the basis of nationally standardized test scores. The group was to be divided into subgroups of those who expressed an interest in science and those who did not. All 30 students were to receive a specially designed mathematics course exclusively for women, with individualized and group counseling, personal assistance and tutoring, lectures, seminars, and field trips. Comparisons were to be made between the science-oriented and nonscience-oriented women on measures of achievement and satisfaction. Pre- and post-test measures of attitude were proposed. As a measure of project effectiveness the performance of the participants would be compared with students in other introductory math classes. The experimental group of 30 was to be compared with all students enrolled in Fundamentals of Math classes and also with women only along the lines of academic performance, professed interest in science, and attitudinal changes during the course of the year. As a measure of the effectiveness of the special course content and format separated from the effectiveness of the teacher, a follow-up study was proposed of students who were enrolled during 1972-73 and 1973-74 in standard sections taught by the instructor for the experimental course.

It was anticipated that the experimental project would provide information on which methods are most effective in the classroom and counseling situation and, if successful, would serve as a model for other college projects designed to encourage able young women to plan academic programs in science areas.

Conclusions and Recommendations

There were several factors that were simultaneously manipulated with the experimental group that complicate the analysis of the contribution of any one of these factors. The course was team taught to all women, used a special text, provided tutoring

sessions, had a smaller enrollment, and different examinations (content and format) than the control groups. The only valid measure to report is the percentage of women who elected additional math classes and went on into calculus. Unfortunately comparative information is not complete on this measure and the institution would not release grades in calculus. However, from informal mechanisms it can be reported that the percentage of women choosing subsequent math courses was higher than the control group, and compared to previous years was significantly higher than either men or women in standard sections. In fact, the evaluators' participant impact survey indicated that more women had decided on a science career as a result of the course than in any other of the projects. Therefore, the project was judged to be probably effective. The comparison of the impact of the course on science-oriented and non-science-oriented women went unreported, and aggregate reports on percentages of women in science careers did not permit the examination of this phenomenon.

High on the list of attributes favored by the participants was the all-female environment (particularly for the older woman) and the supportive nature of the environment as permitted by the small pupil to teacher ratio. It is, however, difficult to sort out the most effective elements. Obviously some of the factors that contributed to participant satisfaction cannot be used routinely in math classes. It would be impractical to have all classes of men or women students only and few schools can afford to cut normal class size in half and at the same time assign two instructors and a tutor to each class. However, the supportive, can-do, atmosphere can be replicated on an extensive basis at no cost to the institutions. Until that time the lower teacher to student ratio and the special emphasis on helping women to reach their own levels of competence through elective all-female classes appears to be a helpful situation.

F. "New Opportunities for Women Chemists: Recovering Lost Skills"
Rosemont College, Rosemont, Pennsylvania
Project Director: Suzanne P. Varimbi
Project Amount: $34,043 (Two years)
Educational Level: Post-Baccalaureate

Proposed Project

The purpose of the proposed project was to (a) identify, locate, and invite the participation of women college graduates of the years between 1959 and 1968 whose major subject was chemistry but who had not worked as chemists since their graduation and would consider full-time employment if their knowledge and skills could be brought up to date; (b) offer a year of intensive contemporary laboratory work, supplemented by adequate review and updating in chemical principles in a lecture and seminar setting; (c) provide a working internship in an individual laboratory; and (d) offer career guidance and placement with suitable employers upon successful completion of the training.

The project was to be evaluated in terms of (a) the participant's satisfaction with the training program, (b) the success of the program in placing participants with chemical industries, and (c) the satisfaction of employers with the participant's training as demonstrated by her performance after a period of employment. The project was funded by NSF for $34,043 with approximately $11,000 additional of matching funds, $7,400 of which came from industry in the form of consultant services and visiting lecturers.

Conclusions and Recommendations

Although this type of program is necessary to update skills, the project was not highly successful if measured by employed participants. Of the 11 women completing the course over the two year period, only two currently have full-time employment; three are in full-time graduate school, two are currently seeking employment, and four decided not to seek employment. Both employed women, however, have been highly complimented by their employers, and Rosemont is continuing the program.

The women participants reported that the paid internships were valuable, as was the supportive, all-female environment. The seminar sessions were more important when conducted as help sessions than as the information sessions. The career guidance and placement activities were minimal, taking only about two hours.

The evaluation team recommends the exploration of several modifications that might increase the number of employed participants at the termination of the project. One modification is not funding this type of project in an area where the unemployment rate is high and likely employers are laying off workers. The project can result in dual problems of (1) disappointment to candidates and (2) backlash among other workers. A job market analysis should probably precede the initiation of projects where there is expectation for immediate employment. Secondly, it may be advisable to concentrate on underemployed women and provide them with stipends. These could be in the form of either on-the-job-experiences, such as the program the Food and Drug Administration is conducting as part of their affirmative action program, or attempting to recruit women with bachelors degrees in science currently employed in clerical or sales jobs to this type of program. Finally, we are convinced that these women need additional psychological assistance to successfully make the transition to employment, and we recommend compl mentary intensive use of workshops, seminars, etc., to assist these women in examining and overcoming the obstacles and problems related to employment.

G. "Recruiting Women to Engineering Careers"
University of Oklahoma, Norman, Oklahoma 73069
Project Amount: $10,912*
Project Director: R. Leon Leonard, School of Aerospace, Mechanical, and Nuclear Engineering
Educational Level: Secondary School

Proposed Project

The project was proposed to test the hypothesis that even a brief (one-week long) experience at engineering school for high school women would provide more information and stimulate more interest in an engineering career than a more traditional deluge mailing. The residential seven-day program was designed to present 50 young high school women with an understanding of what they might do as practicing engineers and as engineering students. The program planned to include presentations by practicing women engineers, discussions, tours, and experimental demonstrations by the various academic departments of the College of Engineering, as well as participation in a "hands-on" engineering project. There was no cost to the participants other than a $15 application fee and the expense of transportation to and from Norman.

The participants were to be selected from those who had completed at least their sophomore year in high school and who had diverse geographical and socioeconomic backgrounds (in order to both attract a cross section of women into engineering and to test the generalizability of the results of the planned intervention). Media publicity and a follow-up program were expected to aid in spreading the influence of the program. The accompanying recruiting effort was expected to serve as a focus of interest for the women currently enrolled in engineering at the University. By serving in the recruitment and follow-up, and as project leaders during the residential program itself, it was theorized that their own interest and enthusiasm would be strengthened. No methods for evaluating the extent to which this reinforcement occurred were proposed.

Evaluation measures were proposed for the participants and for a control group composed of girls who applied for but did not attend the program. Questionnaires were to be used to estimate the impact of the program on career choices as well as on attitudes toward and knowledge about engineering. The evaluation was also expected to measure the attitudes and knowledge of teachers and parents.

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*Plus matched funds from Shell Oil Company.

Conclusions and Recommendations

As an alternative to deluge mailing or high school career day talks, the week long seminar was probably effective in providing information and encouragement to the young women involved, since a greater number of the experimental group reported planning an engineering career than in the control group.

The recruitment procedures appear to require improvement. For one thing, minority participation, although proposed, did not materialize and the participants were exclusively white middle class. Although the high ability and highly motivated youngsters are more easily identified from within this group, no efforts were observed to broaden this participation.

The $15 application fee, certainly modest enough for a week long residential program, may have been a problem since it was not at all clear that all applicants would be accepted. A $5 processing fee to ensure genuine interest plus a $10 registration fee, or simply the promise of returning the $15 to unsuccessful applicants may have been more satisfactory. As observed by one participant, the routine inclusion of freshmen and sophomores would ensure more opportunities for selection of the appropriate college preparation classes.

From the responses to the lectures and to the hands-on projects, it seems clear that succeeding seminars should minimize the former and continue to strengthen the latter. Of particular interest is the observation that most of the participants appreciated the career information provided as being the major strength of the program, even though they enjoyed other more unique aspects of their experience. We recommend special attention to control group procedures in projects designed to provide an informational base for future programs. That is, many of the projects share OU's difficulty in obtaining an adequate comparison group; consequently, no definite conclusions can be reached. We would encourage an emphasis on evaluation rather than implementation in these R&D projects; e.g., the appropriate controls should be retained even if it reduces the number actually participating in the treatment.

H. "Research Introduction to a Scientific Education"
Goucher College, Townson, Maryland 21204
Project Amount: $69,581
Project Director: Barbara Long, Department of Psychology
Educational Level: Secondary

Proposed Project

Project RISE tested the hypothesis that women high school students who are involved in meaningful college level scientific problem-solving activity will develop greater interest in and more favorable attitudes toward scientific careers than their classmates who do not have such an experience. This hypothesis was derived from research and theory in social psychology which indicates that participation, role-playing, and public commitment are effective agents of attitude change. Social facilitation, social reinforcement, and identification with attractive and powerful models are believed to be the social processes that operate in the experimental treatment in order to promote changes in the experimental subjects.

Subjects were to be selected at random among those female high school juniors who scored at or above the 75th percentile in grade level standardized achievement tests on the basis of national norms and were to be assigned at random to three groups, each of about 60 subjects. The experimental group and two control groups were to be tested initially with four different instruments. The experimental group was then to undergo the experimental treatment, which was to consist of a free four-credit course at Goucher College. The course was designed to be an interdisciplinary introduction to scientific research, and was to involve the student in designing, carrying out, and evaluating an independent research project.

At the end of the course, the experimental group and both control groups were to be tested with the same instruments used as in the initial testing. It was expected that the experimental and first control group would not differ in the initial testing, but that in the final testing the experimental group would be higher in interest in and attitude toward scientific careers than it was in the initial testing, and higher than either control group in the final testing. The change in the experimental group from initial to final testing was also expected to be significantly greater than the change for the first control group. A longitudinal follow-up consisting of a questionnaire about career plans was expected to be carried out in the spring of 1978.

Conclusions and Recommendations

Because of the significant, although perhaps temporary, resulting decrease of interest in science, it is recommended that this format not be reused unless alterations are made. The "basic research" format might be used more effectively with higher ability or college age women. This recommendation, given in the Goucher report, is in part due to the fact that there was a positive correlation shown between the grades in the course and their ratings of the project. Further, both comments from the participants reported in the project report and interviews with the DRI team, some of the young women failed to grasp the concept of "research," and the work appeared to be beyond their ability.

A more flexible and concentrated schedule might be used. The final report noted that the one week interval period appeared too long to keep sustained interest on the part of the young women. The two hour period did not allow sufficient work to be done by the instructor and teaching assistants. For example, in the biology experiments, recordings on the crabs had to be made every day. Consequently, the students could not participate in all phases of the research.

Highly motivated students might be used exclusively. Although most of the students were somewhat interested in science, there was some indication that the students were encouraged by their parents to attend because it offered four college credit units for free. Consequently, both the girls and the parents in the upper middle class community saw the program as a practical matter. In some circumstances, incentives, when they serve to draw inappropriate populations, may not be advisable.

The project might be more effective if the students had gotten to know each other. As far as the evaluators could ascertain, few of the women made friends with each other during the project. For those interested in pursuing science as a career, friendship with other women may provide some peer support during work for atypical goals.

I. "Measuring and Improving Awareness and Attitudes of Girls Toward Engineering"
Michigan Technological University, Houghton, Michigan
Project Amount: $26,000 49931
Project Director: Clyde E. Work, College of Engineering

Proposed Project

The purpose of the project was to explore the level of knowledge and attitudes of eighth grade girls regarding engineering. Specifically, the project was intended to answer the following questions: (1) What level of awareness do eighth grade girls, their parents, teachers and counselors have about the job of an engineer, placement opportunities for an engineer, and opportunities for women in engineering? (2) What attitudes do eighth grade girls, their parents, teachers, and counselors exhibit toward engineering, and women in engineering? (3) What effect will contacts with women engineers, information about engineering and experiences with engineering-related activities have on the awareness of and attitude toward engineering of eighth grade girls from various types of schools? (4) Which method(s) of introducing information about engineering is (are) most cost-effective in improving the awareness and attitude of eighth grade girls toward engineering?

The project was to involve eighth grade girls from three different Michigan schools: one in the sparsely settled Upper Peninsula and one each from the suburbs and inner city of a large metropolitan area. The eighth grade girls in each high school were to be divided into five groups of equal size on a random basis. One group was to receive (1) lectures about engineering, (2) discussion with women engineers, (3) audiovisual, and (4) printed information about engineering; a second group was to (1) perform "hands-on" engineering-related projects under the guidance of women engineers, and (2) to receive printed materials about engineering; a third group was to receive printed information about engineering without speakers or projects; a fourth group was to be contacted only through printed information provided to their parents; and a fifth group (controls) was not to be given any special information at all during the experiment.

The changes in awareness and attitudes of these girls with respect to engineering were to be used to measure the influence and cost-effectiveness of different information dissemination methods. The awareness and attitudes of parents, teachers, and counselors were to be surveyed using questions similar to those asked the girls but appropriately worded for their respective roles.

Conclusions and Recommendations

It was very difficult to assess the outcome because of the nature, formating and analyses of the data. However, it seems to be a fair conclusion that none of the treatments had a significant effect on career choice. Several interesting trends were noted. First, the treatment seemed to have positively affected girls already interested/knowledgeable about engineering, and to have negatively affected the others. Consequently, we recommend concentrating on those women already interested in the field. The mailing did not produce any significant effects, although a slight effect of the hands-on projects and role model presentations may have been present. This trend may suggest utilizing long periods of contact and/or more intensive treatments.

The project was well conceived and extremely ambitious and could have provided a great deal of information about effective treatments. However, the funding was probably not adequate for successful implementation. Difficulties were again encountered in attempting to work in the public school system that may have mitigated the possibility of decisive findings, but the evaluation instrument used made it impossible to discern what the findings were. Because of the good conception, but inadequate evaluation, the evaluation team strongly recommends technical assistance to similar projects.

J. "Workshop for Guidance Personnel: Engineering and Science Career Opportunities for Women"
Michigan Technological University, Houghton, Michigan 49931
Project Amount: $31,500
Project Director: Clyde E. Work, College of Engineering

Proposed Project

The objective of the project was to examine the following three questions:

1. Can the awareness and attitudes of counselors and secondary school teachers of science and mathematics toward scientific and technical careers for women be improved by conscious treatment?

2. How much improvement in awareness and attitude can be achieved in a short period of time?

3. What changes in behavior will result from the anticipated changes in awareness and attitude?

The mechanism that was to be employed was a two-week workshop. Thirty-six participants were to be selected to form six project groups, each consisting of four guidance counselors (three from high schools and one from a junior high school) and two teachers of science and/or mathematics. Distribution between males and females was to be based on the proportions in the counselor and teacher populations of Michigan. Participants were to be chosen from schools within about 500 miles of the workshop site to minimize transportation costs.

The program was to consist of about seven half-days of presentations by outside resource people and discussion of the fields they describe and information they present, five half-days of field trips, five half-days of group project work, and three half-days of planning and project presentation and evaluation. In the project phase of the workshop, each group was to choose an approach to follow in presenting information to students in grades 7 through 12; to critically evaluate existing materials, to recommend changes and develop or revise some materials; and decide on a strategy for using the materials.

To measure changes in awareness and attitudes of workshop participants an evaluation instrument was to be administered at the time of application to attend the workshop and again at the

end of the workshop. Changes in behavior were to be identified by use of a second, less formal instrument to be developed by the participants themselves during the workshop. The instrument was to be self-administered at the end of the school year following the workshop, and it called for judgments about the extent to which certain overt behaviors related to career guidance changed in the year after the workshop as compared with the year preceding it.

Conclusions and Recommendations

The approach of workshops for teachers and counselors appears to have been successful and should be replicated. The evaluation team feels that the leverage and ripple effects indicated by the diverse and extensive efforts on the part of the participants in the community the following year may make it an effective mechanism to encourage women to choose science-related careers. Since some of the people incorporated the workshops with their vacations, cost-sharing arrangements between the university and the participants might be investigated. This would also set up a mechanism whereby the university hosting the workshop would benefit. Consequently, it may improve the chances for continuation without additional federal funds.

It may be possible to convey the same information in a shorter period of time, if necessary, and it may be more cost-effective to convey this kind of information to all school personnel on the job.

Some of the group projects generated at the workshops proposed means of sharing this information with parents through PTA programs, etc., as well as the young people. We feel these approaches deserve exploration, e.g., the workshops currently designed for the young women could also be presented at parent/teacher functions.

K. "Promoting the Exploration of Personally Relevant Career Options in Science and Technology"
The American College Testing Program
Project Amount: $49,794
Project Director: Dale J. Prediger
Director of Development Research
Educational Level: Secondary

Proposed Project

This project proposed to focus on ninth and twelfth grade girls who had not previously expressed an interest in a career in science or technology. The primary objectives were to evaluate the effectiveness of replicable procedures for stimulating the exploration of, preference for, and planning toward science/technology careers on the part of girls possessing personal characteristics assumed to be compatible with such careers. The secondary objectives were to identify the perceived barriers, the information needs, and facilitating factors related to the consideration of careers in science, as identified by girls with high potential for such careers. The project proposed two distinct studies: one for ninth grade girls and another for twelfth grade girls.

In the ninth grade study a sample of 360 academically capable girls in three high schools were to be stratified according to occupational preference and educational aspiration, and then randomly assigned to experimental and control groups. The experimental group was to complete a nonsex restrictive interest inventory and subsequently receive a report of results that identified specific job families related to the individual's expressed interests. A second stage treatment was to include group discussions of career planning aid and procedures.

In the twelfth grade study 1,000 girls not planning college major in science/technology but having relevant academic potential were to be identified from among the 120,000 college bound girls taking the ACT Assessment in October 1975. All subjects were to receive score reports including a section relating their career interests to college majors and job families, and booklets on educational and vocational planning. Five hundred experimental group subjects, divided into low interest and high interest groups, would also receive two mailings that noted their potential for science careers and encourage their exploration of such careers by providing related career information.

The project was expected to provide statistically evaluated and generalizable evidence concerning the effectiveness of a

nonsex restrictive interest inventory, and other interventions for stimulating girls' exploration of science careers. Outcome measures would include amount of subsequent career exploration, changes in career preferences and plans, and enrollment in science-related courses.

Conclusions and Recommendations

This study indicated that mailed material, in the absence of other interventions, is not sufficient to change the career preferences of high school seniors. The same must be concluded regarding the nonsex restrictive inventory and class discussions. In sum, while such interventions may be good, they are not enough to counteract existing beliefs and mores. Therefore, the evaluation team feels they may best be used in conjunction with more intensive interventions, or with women already expressing a preference for a science-related career.

Because of the design and analysis, the outcomes of this experiment were conclusive and were reported with standard terminology. Since conclusive outcomes were the exception rather than the rule in this set of experiments, the question is raised regarding the relative efficiency of funding researchers with a background in experimental design rather than persons in other disciplines.

Because of the interesting differences reported by ACT perceived barriers between the ninth and twelfth grade girls, we recommend a study of the perceived barriers at the time they are perceived rather than in historical retrospect. The materials used in this project were excellent and should be replicated where possible. The Assessment of Career Development appears to be a good vocational interest test and we would recommend its usage in other projects. The booklet Women in Science and Technology: Careers for Today and Tomorrow is a well prepared document that could be incorporated into a wide variety of other career education programs.

L. "Increasing Women in Science Through Reshaping Role Perception"

Mary Baldwin College, Staunton, Virginia
Project Director: Dr. Donald Thompson
Project Amount: $99,681.98
Educational Level: Post Secondary

Proposed Project

The specific aims of the project were to:

- increase the student's awareness of careers in science open to women;
- influence the student's attitudes in the direction of more favorable perceptions of such roles;
- enable interested students to obtain direct experience in areas of possible science careers through January term and summer internships;
- organize the information obtained about career options into a permanent and ongoing file so that faculty and students at the participating colleges and other interested colleges may readily retrieve this information.

Four women's colleges--Hollins College, Mary Baldwin College, Randolph-Macon Woman's College, and Sweet Briar College--were to participate in a program that included several components. These included seminars featuring successful women scientists at Hollins College and Mary Baldwin College; exposure to a videotaped package on science careers at Hollins College, Mary Baldwin College, and Randolph-Macon Woman's College; and a variety of internships in scientific careers at all four colleges.

The seminars were to feature four or five role models who were on one campus for approximately one day at each college. During each of the six college seminars, discussions were open to all students and then the role models were available as resource people in science classes and as consultants to the students on an individual basis.

The content of the 30 videotape presentations was generated by interviewing successful women scientists (typically the seminar role models). The project director encouraged the science and mathematics faculties at Hollins College, Mary Baldwin College, and Randolph-Macon Woman's College to incorporate the videotaped presentations into their respective science courses.

During the course of the project, the director assembled detailed information on careers in science for women. This information was disseminated at the close of the project to all four campuses. In addition, opportunities were made available for student externships during the January term and during the summer months. These externships were to include 160 hours of on-the-job experience at various industries and agencies involved in science-related endeavors for which credit would be given.

Evaluation of the project was to be made by analyzing the results of tests on attitudes toward science and scientific careers given before and after the program at the four colleges and by cross-comparisons among all four colleges.

Conclusions and Recommendations

The project comprised of seminars, career counseling, externships and videotaped career information represented the most comprehensive intervention of the projects. The project was aimed at first year students and the junior science majors at four women's colleges, although all students from the schools could participate in some of the program activities. These activities represented an increased effort and modified focus of ongoing programs which have now been institutionalized at Mary Baldwin College. There was differential participation in the project: the campus of the project director participated to the greatest extent; junior science majors were more involved than freshmen; but freshmen who anticipated a science major and those who did not were proportionally represented.

During the period of project activities the percentage of declared science majors increased substantially at the campus where the activities were concentrated. Although this may have been due to multiple causes, it seems likely that the project activities or their secondary impacts contributed to this effect. No specific activities can be implicated because the target group of freshmen and juniors declaring science majors remained relatively constant and shifts from science to nonscience majors and from nonscience to science* were not significantly different. The project can also be judged a success if rate of participation and participant satisfaction are used as criteria. In addition, many positive secondary outcomes resulted on the Mary Baldwin campus.

There were several parts of the project that were suggestive and interesting, but not completely explored by the project evaluation. These are:

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*This was treated as an equally probable event in the analysis although national data suggest that a shift from science to nonscience is the more probable event.

1. The cooperative arrangement between relatively contiguous schools represented a promising cost-effective approach to career information activities. Yet the evidence indicates that the schools participated and benefited differentially. It is possible that the logistical barriers encountered may be surmounted once the activities were operational rather than experimental. On the other hand, personal commitment and responsibility of the institutional members may have more far reaching affects than the activities themselves.

2. The study had the potential for reinforcing existing decisions. While it certainly performed this necessary function, it also provided career information for those women not choosing science-related careers. The overall effect on the campus where activities were concentrated suggests that career activities may be beneficial to both groups.

3. The externships represented a unique component of this project, and, in general, served to enhance career commitment among the junior science majors. In addition, such externships provide a close and more realistically based relationship between the community and the colleges that should serve both to increase career awareness on the part of the faculty and to increase the employability of its graduates.

4. The most unfortunate part of the experiment was its failure to indicate the effects of exposure to project activities in order to provide an indication of necessary level of effort needed to reverse the flow of women away from science majors. In this experiment, as with almost all naturalistic experiments, no reasons for the increase in science majors could be postulated from the experimental results, e.g., the differential effects of project activities on attitudes was not determined.

5. The fact that role models were graduates of the local colleges probably enhanced their effect, e.g., the majority of the role models had graduated from Hollins or Mary Baldwin. This likely increased student identification with the role models and their success seemed attainable.

6. The affect of the additional career counseling offered by the project is not clear; since its influence on freshmen was not analyzed. In addition, the low attendance at the weekend seminar on career counseling and assertiveness is not discussed. The lack of enthusiasm on this topic is interesting in light of the good reception of the seminars and externships.

7. Many of the project activities, such as the externships, and use of career material and videotapes are being continued in the absence of NSF funding.

CHAPTER III
PROGRAM OBSERVATIONS AND COMPARATIVE ANALYSIS

Although aimed at science-related careers, many of the recommendations of this report, especially at the primary and secondary school levels, apply equally to all nontraditional jobs, especially those that are highly technical. Therefore, the authors feel that the same recommendations may apply to many interventions designed to increase the awareness of women regarding employment alternatives and options and to increase their participation in many nontraditional careers.

The projects described in this report were aimed, in general, at motivating and reinforcing decisions to enter professional careers in science, for preparing effectively for those careers, and for removing barriers to the attainment of those aspirations. All of the scientific and engineering positions described in the materials developed by these projects required at least a college degree, and most required advanced degrees including a doctorate. On the whole, those women receiving doctorates in science-related fields are productively and continuously employed, and salary differentials between men and women is less than men and women with less education. That is, it appears that a Ph.D. may be an "equalizer." Since these women may also serve as visible examples of the employment potential of females, they may serve to increase the aspirations of other equally talented women. Therefore, it would seem desirable to increase the proportion of women in this category. Since the recommendations may only apply to a small number of women, they are treated independently in this report. The recommendations incorporate the evaluators' observations, derived from a comparative analysis of the projects, and should be considered as hypotheses to be tested since definitive conclusions could not be made from the present projects.

Although this report has concluded that there is probably a higher success rate to be expected by funding programs for high ability, highly motivated groups, and has recommended concentrating on reinforcement programs for these people, there is no evidence that the need is not greater among low motivation, low self-esteem groups. Assuming these groups are larger, it is possible that the potential output would be greater even though the "success rate" may be lower.

Moreover, the consequences of adequate science and mathematics background and awareness of broad career options may have widespread impact on women in the society. For example, comprehension of mathematic and scientific principles may serve to "demystify" a technological environment and decrease a sense of helplessness and lack of self-confidence. Further, the acceptance of nontraditional career options, even for those not choosing to pursue them, may create a more supportive environment for those who do choose them.

Finally, a number of nontraditional nonprofessional science-related jobs exist which, for many women, would represent both economic and social benefits: electronics-, video-, sound- or flight-technicians, computer operators, highly skilled labor, etc. These are jobs that require science-oriented preparation and contribute to the emerging role of women as productive partners in providing highly specialized support skills in a technological society. Although these positions do not usually require college degrees or the same high degree of academic learning ability, they do require early exposure and commitment, continued encouragement, and special training. They represent improved earnings and more respected skills than many traditionally female jobs. For these reasons it may be just as desirable to increase the number of women participating in these careers. Recommendations concerning career education programs are given separately in this report.

Reentry is a critical area for increasing the participation in science-related occupations, e.g., many more women are qualified for these occupations than are currently employed in them. For example, the Scientific Manpower Commission reports that women earned about 35 percent of the bachelor's degrees in mathematics between 1948 and 1973, 25 percent of the master's degrees and 10 percent of the doctorates. Far fewer at each degree level are employed, and the underemployment appears to increase as the level of degree decreases. Approximately 87 percent of the Ph.D. recipients in math are employed, but only about 28 percent of the master's degree recipients and about 31 percent of the bachelor's recipients are working in math related occupations. Similarly, the pool of women qualified to be employed as chemists is about 20 percent of the total pool, but only about 8 percent of the working chemists are female. The percentage of working Ph.D. recipients may be higher than that of lower degree recipients only because a greater percentage of them are continuously employed.

Clearly, underutilization of females in the economic sector is a widespread problem. In fact, in view of the pool of qualified women, it may be more imperative to address the reasons resulting in their underutilization and to develop remedial interventions than to encourage more women to prepare themselves for these careers. Consequently, reentry programs, designed to meet the specialized educational and emotional needs of all women, professional or not, are discussed in a separate section.

A. Professional Careers--Observations From the Projects

Among the objectives of this contract was the examination of the results occurring across projects in order to isolate observable patterns by the type of intervention, types of materials, age groups and other variables that might have relevance in the implementation of similar projects. This analysis may be called program strategy analysis or comparative analysis.

Unfortunately, none of the projects proved to be effective as judged by rigorous statistical methods, either because of the problems in design, control group implementation, and outcome measures, or because the treatment actually had no effect. Therefore, the evaluation team employed a "preponderance of evidence" criteria for judging the effectiveness of a project. That is, some combination of the statistical results, other nondesign outcomes such as experiences with a roughly comparable group, the opinions of the participants, and our own impressions was used to judge whether a project was effective. Under these conditions, even if "success" was indicated, no causal reason for the success could be determined. Consequently, commonalities between the more successful and less successful projects were explored. Because of the experimental limitations on the conclusions, these observations should be treated as hypotheses to be tested, and not as recommendations.

Even when statistically significant results were obtained by the experiments, these were frequently difficult to interpret and place in perspective. The difficulty was encountered under several circumstances. First, frequently a multitude of items were used in the evaluation instrument, but only a few items were significant. Further, when a variety of outcome measures were used, some of the significant outcomes may have been interesting and/or beneficial, but not directly relevant to encouraging women to choose science-related careers. A third difficulty was when different "control" groups indicated different results, such as with the University of Kansas study. A fourth difficulty was the probable Hawthorne effect, where the novelty of the intervention may have skewed the results. On the other hand, multiple year projects (University of Oklahoma) were difficult to analyze because the effects may have been cumulative and not directly related to the segment that NSF sponsored.

Therefore, the indicators used to estimate effectiveness, were at best, only global measures, frequently not conceived of as part of the experimental design. Consequently, the reason for the outcome could not be conclusively determined. For example, the special math course at UMKC appeared to be effective in encouraging women to take subsequent math courses. However, the comparison group were those taking math courses the year before, and those taking a different math course the same year. Therefore, the interest in mathematics might be attributed to any of the following: (1) the

actual curriculum, (2) the method of instruction, (3) the additional tutorial help, (4) the all-female classes, (5) the influence of the instructors, (6) the "Hawthorne" effect, and (7) the differences in the population that would sign up for the course.

The projects are described in three tables. Table 1 breaks down the 11 projects by the age of the participants, the sex of the participants, the types of treatment, and whether the treatment was available at different intervals (spaced), or given all at one time (massed). Finally, the outcome of the experiment is given. Table 2 lists the products of each of the projects, and their potential applicability, and Table 3 contains a rough estimate of the cost to reuse that particular intervention and a subjective assessment of its effectiveness.

The subjective assessment regarding the effectiveness is reported in three categories: probably effective, no effect, and possibly a negative effect.

The special math course offered by the University of Missouri at Kansas City (UMKC), the workshop offered by the University of Oklahoma and the workshop offered by the for counselors and teachers and the workshop offered by Michigan Tech of Kansas appear to represent the most viable strategies. UMKC reported a much greater percentage of women taking subsequent math courses, although no true control group was available for statistical comparison. Similarly, the University of Oklahoma workshop reported a higher percentage of women reporting that they would choose an engineering major than a noncomparable control group. The participants in the University of Kansas workshops reported more science majors than the year before, but about the same as the control group composed of individuals who were invited to the workshop but did not attend. The counselors/teachers workshop, sponsored by Michigan Tech, reported a consistent, but slight, increase in awareness of engineering as a career for women, and reported increased activities regarding these careers on a form that the participants devised. Consequently, the commonalities between these programs that may have been successful are discussed.

The ACT nonsex restrictive vocational inventory, the MIT film, the Michigan Tech program for students, Queensborough's cassettes and slides, and Rosemont's program to update skills reported having little effect when used as the primary intervention. Rosemont was included in this category because at the time of the report, only two of the eleven participants had obtained jobs and this appeared to be about average for women making some active effort to get them. Goucher and Policy Studies indicated that their project might have had a negative effect on the participants. Commonalities between these projects are discussed.

Some of the commonalities we observed and areas where we recommended further investigation are as follows.

TABLE 1
PROJECT DESCRIPTIONS

	Grade	Sex/ Sample	Intervention	Contact Time	Results
Michigan Tech	8th	F	Presentation by role models of preparation, job content and lifestyle in engineering.	4 hrs.	No significant results.
	8th	F	Demonstration projects.	4 hrs.	No significant results.
	8th	F	Mailed printed matter.	1 hr.	No significant results.
ACT	9th	F	Given non-sex biased career inventory, discussion groups, and printed matter.	2 hrs.	More career exploration, increased congruence between aptitude and aspirations.
Policy Studies	10th, 11th	F	Workshops in school on lifestyle and career clusters.	12 hrs.	No significant results--slight trend toward disinterest in science.
MIT	10th, 11th, 12th	M,F	Film and booklet.	1 hr.	More in experimental group undecided about career plans--same amount definitely wanting engineering.
Goucher	11th	F	College level semester course in science.	15 hrs.	Significant decline in interest in science at end of course, but 58% of respondents planning science career one year later.

TABLE 1 (continued)

	Grade	Sex/ Sample	Intervention	Contact Time	Results
Oklahoma	11th, 12th	F	Workshop of mixed discussions, labs and field trips.	40 hrs.	Probably increased number of women planning engineering careers (not adequately tested).
ACT	12th	F	Mailings of relevant materials & VIP inventory.	2 hrs.	More planning taking courses in science but more control planning to take math
Kansas	12th	F/high ability	Workshop.	8 Hrs.	Significantly more women pursuing science careers than women in prior year control; but same percent as women who were invited to workshop but did not attend.
Queensborough	9-12	M,F	Slides and cassette of six role models.	1 hr.	No significant differences.
Michigan Tech	Parents	M,F	Printed matter mailed.	1 hr.	No significant differences.
Michigan Tech	Teachers	M,F	Printed matter distributed.	1 hr.	No significant differences.
Michigan Tech	Teachers, counselors	M,F	Workshop with role models, labs, discussion.	80 hrs	No significant difference in participants but may have increased activity in school community.
Kansas	Parents	M,F	Workshop on career materials with daughters.	8 hrs	Not measured; daughters reported it as positive.

TABLE 1 (continued)

	Grade	Sex/ Sample	Intervention	Contact Time	Results
Missouri	College	F	Special math course.	1 sem. 80 hrs.	More took further math courses in sequence.
Rosemont	Post-grad	F	Course to update skills and industry internship.	100 hrs.	About 1/4 did get jobs in science-related areas.

TABLE 2
PROJECT MATERIALS

Material	Appropriate Age	Description	Dissemination
1. Choosing a Career--Women's Work: Engineering (MIT) book	All secondary and college engineering students.	Description of three female engineers--student, young professional, middle age professional/all lifestyles represented.	May be used for TV and distributed on film by Educational Development Center Inc. Now available from MIT catalogue.
2. Women in Engineering (MIT) film	All secondary and college engineering students.	Shows students and professional women in engineering at work and home.	"
Exploring (ACT)	Secondary.	Updated version called VIESA: book on job clusters and aptitudes, career planning--non-sex restrictive.	Part of Houghton Mifflin "Career Planning Program."
Vocational Interest Profile (VIP) (ACT)	Secondary.	Non-sex restrictive career assessment/intervention.	"
Women in Science and Technology: Careers for Today and Tomorrow (ACT)	Secondary.	Booklet describing realities on women in science-related careers.	ACT. Nice booklet that should be widely used.
Workshop format (Kansas)	Secondary, college.	Series of self awareness exercises.	None.
Women in the Professions (Kansas)	Secondary, college.	Home study course designed for three credits.	None.

TABLE 2 (continued)

Material	Appropriate Age	Description	Dissemination
Women in Science (Queensborough)	College, graduate school.	Interviews with six of top female scientists: mixed ethnic background and variety of lifestyles.	American Association of Physi Teachers and NSTA distributin Should probably be used in co junction with other material except at graduate level--may be better at college level th secondary.
Workshop Curriculum (Policy Studies)	Secondary	Mixture of job clusters and lifestyle alternatives.	None.

TABLE 3
PROJECT COST PER PARTICIPANT

	Intervention	Hours*	Cost	Effectiveness
University of Kansas	exploration workshop	8.00	10.00	possibly positive
Policy Studies	career education course	12.00	50.00	no effect or negative
Queensborough	slide and tapes	1.0	1.00	no effect
Massachusetts Institute of Technology	film	1.0	2.00	unknown
Univ. Miss. at Kansas City	math course	64.00	350.00	probably positive
Rosemont	chemistry course	100+	800.00	positive for small proportion
University of Oklahoma	workshop	40.00	300.00	possibly positive
American College Testing	literature mailing	.10	1.65	no effect
	nonsex restrictive interest inventory	1.0	1.00	no effect
Goucher	research course	30.00	1,000.00	no effect or negative
Michigan Tech	student literature	1.0	1.55	no effect
	student seminars	4.0	30.00	no effect
	parents literature	1.0	1.55	no effect
Michigan Tech	counselor teacher workshop	112.00	400.00	probably positive

*Estimates minimum contact time; the time may have been greater for some participants.

1. Concentrating on women who are already interested in science. In general, it is thought that projects providing support for women interested in science, and projects to remove barriers to the full participation of these women, are preferable to direct motivational projects to encourage women to change their interests for the following reasons:

- They are more easily justified in terms of providing equal opportunity and avoiding criticisms of reverse discrimination.
- They are less apt to result in unsatisfactory career choices.
- None of the projects observed appeared to be successful in changing attitudes.
- It is difficult to switch from a nonscience to a science area. That is, beyond the junior year in high school, compensating for inadequate math and science backgrounds is difficult.

Since the projects examined did not appear to be successful in changing occupational choices at the senior high level, intensive support and information could be provided to those women having the necessary background, ability and motivation to pursue their existing interests.

While there is not an established theory on the vocational choice patterns of women, there has been a growing number of studies in the area. Most of the literature appears to be in agreement that there are many shifts in both occupational interests and commitment to a career. However, the literature uniformly indicates that from preadolescence on the shift is toward typically feminine careers and away from nontraditional careers (e.g., Angrist, 1970; Harmon, 1971). Consequently, interest should be defined very liberally, and should not be interpreted to mean an expressed career choice.

The kinds of support that may be helpful can come from a wide variety of sources, and the most important source will be different for each age group. These support programs could include parental support, encouragement from teachers, peer support (both same and opposite sex), guidance counselors and from the institution as a whole. The range of possible forms these programs may take is virtually infinite and could include counselor workshops, special housing programs, special workshops for science/math teachers, or sex-segregated classes.

2. Concentrating on women with above average aptitude and motivation. Realistically, professional careers in science-related areas require intellectual ability, an adequate background derived from math and science courses, and more than average motivation. In fact, having completed advanced mathematics and science courses successfully is probably a good indicator of ability and motivation. Although there is a controversy about the measuring of aptitude and ability (Prediger and Hanson, 1976; Schmidt and Hunter, 1974), it seems feasible to determine whether individuals have at least average ability or are highly motivated by utilizing either standardized test scores, grade point averages, or the courses chosen and completed.

Many studies have shown a relationship between career commitment in general and measures of accomplishment and/or aptitude (e.g., Hoyt and Kennedy, 1958 and Tyler, 1964). Further, a higher level of aptitude appears to be related to the choice of nontraditional careers, e.g., those occupations dominated by males (e.g., Astin, 1971). Consequently, it would appear that intensive and/or expensive programs should concentrate on women who have either a high ability or who have taken the necessary requisite course or overtly express an interest in science.

This hypothesis was substantiated by the projects: the more successful strategies/projects utilized a motivated population, while the ones judged less effective did not. For example, the Kansas workshops invited only women that had been selected for admission to KU, Oklahoma University required active motivation to apply, as did Michigan Tech. On the other hand, the two studies categorized as "possibly negative" reported severe problems getting young women of adequate ability; and one report contained reservations about the participants' motivations. The majority of the studies reporting no results had no special requirements regarding either the motivation or aptitude of the participants.

One indicia of motivation may be found in the participant selection procedures: University of Missouri at Kansas City, University of Oklahoma and Michigan Tech all had self-selection procedures; only those individuals who wanted to participate attended. On the other hand, some of the projects had more or less captive participation; the intervention was administered in classrooms, or the entire class participated.

The self-selection, of course, provided a strong experimental bias toward success, and mitigated any conclusions about the intervention itself. However, since the aim of further implementation is to bias the projects toward successful outcomes, voluntary participation may be a judicious procedure.

3. Using workshops as a format for the intervention. Although it is very possible that the selection procedures for the workshops was a greater determinant of outcome than the format, the hypothesis is proposed that concentrated "live-in" workshops may be effective. These workshops may offer a wide variety of activities as in the University of Oklahoma, Michigan Tech and KU projects, may be the more enjoyable and effective format to provide support and information for young women interested in science.

4. Encouraging participant interaction. Social psychology would predict that other persons sharing similar outlooks and attitudes could provide reenforcement for women choosing nontraditional careers and/or lifestyles. The projects provided some evidence for this assumption. The live-in workshop, where participants with similar interests spent concentrated periods of time together, provided a perfect environment to obtain these rewards. In the special math class, informal tutoring at the noon hour was available and provided the same opportunity. On the other hand, the larger class situations and/or media presentations were generally less successful and did not provide an opportunity for participant interaction. The Goucher project entailing basic science research did provide this atmosphere, but participants reported that they did not form any new friendships.

5. Using sustained contact periods. When the treatment did not require intense concentration and work, the longer periods of time for administration of the treatment appeared to be more effective, possibly because of the increased opportunity to make new friends with people sharing similar outlooks. The more successful interventions appeared to require at least eight contact hours. It is possible that short "one-shot" affairs may not be sufficient to counteract existing cultural mores discouraging women from choosing science-related careers. However, since some other projects of greater length did not appear to be successful, careful examination of related variables should be conducted. The length of exposure may be one of the reasons why the media products did not appear to have a demonstrable effect.

6. Using role models in as many situations as possible. Uniformly, role models appeared to be the most effective component of some of the projects and were the primary material for the media products. The original connotation of a role model was a person in a position of influence that one could identify with; most of the projects did incorporate these younger women in mid-level positions. In one of the projects containing a mix of role models, the younger women were judged most effective by the participants. In this respect, then, choosing the role models closer in age and only slightly above the level of aspiration of the participants may be advisable.

The evaluation team, however, feels that there is also real value in depicting the most successful women of our time. Although

very few women (or men) may be able to identify with these outstanding people, they demonstrate that a woman can "make it," they are a source of pride for the women, and may serve as an inspiration. Consequently, a mix of age groups and levels of accomplishment (as well as lifestyles, ethnicity and so on) is recommended.

The area of concentration of the role models did not appear to have any impact; the more important factor was that they genuinely enjoyed their work and their lives. Finally, the best format for role models may be allowing them to interact with a small group of females.

7. Using "hands-on" experiences. In many of the projects, various types of hands-on experiences were used. Very frequently, these were engineering or science projects. These activities were rated highly by the participants. They appeared to be most effective when they were group projects, continuing over a period of time, e.g., when they facilitated the formation of social relationships. Also the active participation in these and other activities appeared to enhance the effectiveness of every kind of intervention.

8. Segregating some activities by sex. Although in theory, as well as in practice, sex-segregated classes might be considered counter productive since women live and work in a world with men, a consistent comment on the part of many of the participants was that they preferred all-female seminars. This comment extended to a preference for female tutors in math. The young women commented that they felt more free to ask (what they considered) "dumb" questions, to appear as "bright" as they are, and to discuss their personal life and ambitions. Consequently, although a sad commentary on socialization and peer pressure, sex-segregated classes appear to be useful in situations where remediation skills or personal questions are involved. These classes, however, could incorporate methods to lead to more open discussions with male peers and parents, once the women have gained self-confidence and support from their same-sex peers.

9. Emphasizing the social contribution of science. One of the myths of science-related careers, not directly dispelled in any of the projects we observed, is the absence of emphasis on social importance and social interaction in science careers, e.g., scientists/engineers were frequently not portrayed as persons with extensive social/environmental concerns and responsibilities who interacted with the community. Since women are reputed to be very interested in social welfare, emphasizing the input of science to the well-being of society, and a deep involvement with people, might enhance the desirability of the profession. Moreover, the greater the number of scientists whose interests supercede "the testtube," the greater the potential impact of scientists on society in areas other than technology.

Consequently, we would recommend, on the basis of the experience gained by these projects, further examination of a format where able and motivated young women, having some interest in science, gather for a workshop having the ingredients of role models, hands-on experiences, and the opportunity for new friend-

ships. This format is quite similar to the existing Student Science Training Program,* which still does not have full participation by females, and has a demonstrated success rate in turning out scientists (Vidulich, Christman, Drake and Kirk, 1976), e.g., about 50 percent of the females participating in these programs expressed career aspirations in science.

Similar experiences could be provided for both college and graduate students. David (1971) concluded that "earning a doctorate is the factor that most equalizes the women to the men in science and engineering," in terms of employment, salary and contribution to their field (p. 222). However, of students entering graduate school, possibly twice as many men as women actually complete the degree. If the doctorate is an equalizing factor in employment, salary and accomplishment, special programs to encourage completion (and to contribute to the supply of role models and female faculty members) should be conducted. These programs might include female colloquium, particular speakers, support groups, internships, workshops and seminars or nationally conducted week-long seminars for female graduate students.

10. Removing institutional barriers to female participation in science careers. Although the NSF projects were not directly concerned with overt discrimination, many observations regarding the obstacles they presented became apparent to the evaluation team.

Not only do women pursuing nontraditional careers encounter social barriers, they frequently encounter institutional barriers. Even those schools professing equal opportunity for financial aid, intern programs, etc., frequently have not adapted them to the special needs of women. This discrimination, and misinformation, starts very early and continues through her educational and job career, and has to be a discouraging factor even to highly motivated women having superior ability. For example, assistantships in science have positive effects on the junior and senior science majors. It not only serves as a financial aid, it is interpreted as a "vote of confidence" and serves to increase interest, exposure and expertise in their areas. Assistantships also provide additional encouragement to go to graduate school, and usually provide a closer relationship with a faculty member. Assistantships to declared science majors may improve the retention rate and result in more women attending graduate school in science. Yet discrimination

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*The Student Science Training Program sponsored by NSF has the basic goal "of providing talented students learning opportunities above and beyond those normally available in most formal science education programs" (NSF, 1975). Typically this involves high school juniors living on a college campus for a period of time during the summer.

in granting fellowships is common. For example, consistently less than 3 percent of NASA fellowships go to women (about twice the rejection rate for females as males), and about 18.7 percent of NSF fellowships went to women in 1972-73 (Nies, 1976).

B. Career Education

There are a virtual plethora of problems associated with current practices in career education. These include sex stereotyping of careers in literature and media, lack of awareness of alternative careers and lifestyles, sex-biased counseling, and so on. However, two appear to be especially relevant for science-related careers.

Increasing the education in science and math has many benefits for all women, whether or not they choose a career in these fields. It allows for greater perceived control of their environment, and provides them with a background adequate for a wide variety of careers. In the area of general career and science education, we recommend:

1. Differentiating between career education and programs to encourage women to choose science as a career. This conclusion is drawn from the recommendations to concentrate on women who have already expressed an interest in science and/or who have taken the necessary courses by the senior high level. However, some general encouragement may be necessary to obtain these prerequisites, e.g., prior to that time, career education courses for all students is important. Utilizing some of the media products and portions of the Kansas and Policy Studies Programs to make young women aware that science is a career option and to encourage them to obtain the necessary background (e.g., math and science) to keep those career options open is important prior to the senior high level. These programs could be done inexpensively, reach a large number of students, do not necessitate "special" programs for women, and become part of the career education classes in the school systems. These programs could incorporate the "lifestyle" considerations of a career.

2. Emphasizing the importance of continuing mathematics preparation. Since mathematics appears to be the "critical filter" to a wide variety of occupations it is imperative that females continue these courses in order to keep their career options open.

A great many methods in assisting women in mathematics are involved. These include developing innovative methods of teaching math adapted to the typical strengths of females, offering special tutorial/remedial courses, math anxiety counseling, and emphasizing an awareness of the effect of discontinuing math education.

C. Job and Educational Reentry Programs

Thirty-seven percent of women with children under six years of age and 50 percent of women with children between the ages of six and 17 were working in 1975. Since a majority of these women choose to remain out of the labor market for the first years after the birth of a child, these figures indicate that many women reenter the labor market after some period of economic inactivity. These women are typically re-employed in jobs that do not utilize their full potential, and jobs that typically are lower paying. This underemployment is more acute for the woman entering the labor market than for women who are continuously employed.

The woman attempting to reenter the labor market faces a multitude of problems and adjustments. First, her technical skills and theoretical understanding of her field may be outdated. This problem may be addressed by an additional educational experience. Second, her confidence in her ability to get or hold a challenging job may be diminished. She may not know how to interview for a job. She may have many logistical problems, such as arranging for child care, transportation and dinner each night. She may not have the support of her family and friends. She may be afraid of failure (or success). She may face very real discrimination on the part of employers. Consequently, the transition to work after a period of unemployment includes a dramatic change in lifestyle for herself and her family, and a change in her perception of her role.

After the childbearing years, many women want or need to reenter the labor market, i.e., they want to transition to work. For many women, this transition may include completing an advanced degree, or acquiring specific job related skills. Considering the underemployment and underutilization of the talents of these groups, the type of assistance given these women is important. Therefore, we recommend:

1. Concentrating on underemployed women. It is suggested that reentry programs for mature women might utilize already working, but underemployed, women. Updating the skills of women already in the labor force might alleviate problems in recruitment and placement. These women would have already adjusted their family arrangements to meet their work schedules, and have shown that they are motivated for employment. They may be currently underemployed, e.g., rather than capitalizing on their scientific skills, they may be working as secretaries, sales personnel or other jobs unrelated to their training. The major obstacle to this approach would be that their families may be accustomed to or dependent on the additional income, and a period out of the labor force to update their skills may impose an economic hardship for them, unless financial assistance is provided.

One successful approach is the current affirmative action program in the Food and Drug Administration. All males and females without opportunities for advancement are eligible for an on-the-job training and work release time for school in order to be qualified as an inspector. Normally a heavy science background is required for this position. The program enables advancement into a science-related career without initial salary penalty.

2. Considering employment prospects in the locale. It would appear logical to fund programs to update skills in areas where the labor demand is not abnormally low. That is, it is not cost-effective to prepare women for jobs that aren't available, and would be a discouraging experience for those women, and can elicit adverse community reaction among unemployed males and their dependents.

3. Funding projects to update job related skills. While these programs are typically expensive, it appears that some assistance to women to update their skills may be necessary. One of the side benefits of these programs may be that it allows for a more gradual adjustment to a working environment.

4. Making special seminars, workshops and counseling available. Since the majority of these women will have to make personal and familial adjustments to accommodate their new schedules, and job demands, special programs to help them overcome the perceived barriers and obstacles associated with employment could help to increase the success rate of these reentry programs. That is, a woman's ability to get and hold a job, even though she has adequate skills, may be dependent on her attitudes and motivation for work, i.e., her job readiness. It is recommended that assistance in developing an appropriate job readiness profile be a component of all reentry programs.

D. Administrative Recommendations

1. Improving the quality of the experimental research. There are several ways to attempt to improve the quality of the research. These include (a) more selective funding, (b) providing technical assistance, and (c) use standardized measures and long-term follow-up.

a. More selectivity in funding. Overall, the quality of the projects, as experiments, could have been improved. One factor was the circulation of the announcement of the availability of support for these projects. Most of the project directors reported learning about the program from the flier received at a dean's office. Consequently, only a very few proposals were received and very few requests for funding were rejected. A better mechanism of disseminating information to prospective applicants should be developed.

A concomitant observation is the difference in results obtained by experienced researchers and those with less experience in experimental design. That is, all of the project directors appeared to be committed to increasing career options for women, and to have strong backgrounds in science. Most, however, did not have an extensive background in experimental design and evaluation, adequate knowledge of control group procedures and statistical analysis. The results of only two projects, although not confirming the hypothesis, allowed some degree of confidence in the outcome. However, there are many benefits to providing a wide spectrum of individuals. These include increased capability by personnel to conduct such projects, increased commitment to women's projects, and possible beneficial effects to the participants. Therefore, a conscious strategy should be developed regarding the importance of reliable experimental results. Should it be decided that confidence in the experimental results is important, some percentage of the project directors should have a demonstrated capability in project management, experimentation, and evaluation.

b. Providing technical assistance to the project directors. NSF has traditionally adopted a "hands-off" policy to grantees. While this policy has many advantages, providing technical assistance in evaluation procedures and instruments to those project directors requesting it might mitigate against the technical problems encountered in many of the projects.

If the current "hands-off" policy toward grantees is maintained, a brief project directors handbook, containing a description of commonly occurring barriers to the implementation of both the project and the experimentation/evaluation is recommended. The case studies do not serve this purpose well because (1) the case studies are too long, (2) are not necessarily perceived as relevant to project needs, and (3) may not be fair to the individual project reviewed, since they were written for other purposes.

This booklet could contain, for example, an overview of problems encountered when dealing with recruiting, working in the public school systems, or in developing evaluation instruments.

c. Using standardized evaluation tools and long-term tracking. If experimental projects are to be continued to encourage women to choose science-related careers and the independent measure is a questionnaire of any kind, the evaluation team recommends that reliable and validated instruments be provided for use by the project directors. Each of the projects has designed at least one such instrument, and the best items could be chosen and validated from this pool or one of the better validated ones, such as that used by ACT, could be used. It is felt that a standard unit of measurement could be developed for all similar projects. Even if a project wanted to have additional dependent measures, at least a

comparison, either of the project outcome or its evaluation methodology, would then be possible. It is recognized that a single instrument may not be appropriate for all types of experimental designs and that the use of a validated instrument will insure neither superior experimental nor evaluation procedures.

2. Coordinating intergovernmental activities and delineating activities. There are several federal agencies currently working in the area of career education with some emphasis on women. These include the Women's Educational Equity Act (OE/HEW), Education and Work Group (NIE), Office of Career Education (HEW), and the American Association for the Advancement of Science, Office of Opportunities in Science. Ideally, full sharing of resources should occur. In addition, some agreement about areas of concentration might be possible. For example, NSF might focus on high ability women interested in science, and only assist Office of Career Education in making younger women aware of nontraditional career opportunities. Further, OE/HEW is already planning dissemination activities for similar programs and NSF could add their material to this clearinghouse.

3. Continuing experimental activities by NSF and disseminating knowledge about its programs. In addition to the increase in knowledge gained by the experimental projects, the team has observed some psychological benefits just from the existence of the program. Even the participants commented that they were impressed that "somebody" was interested in their careers. Further, in the current climate of the women's movement and the possible defeat of the ERA, the existence of federal interest and support is imperative for the morale of the people committed to career/life options for women. However, the evaluation team feels that a great many benefits in formulating effective policy would be derived by continuing in the experimental mode, both to NSF, as well as to other agencies. That is, building on the present experience could enhance knowledge about effective methods of implementation.

4. Including specific programs for minority women. In neither the women's projects, which typically contained no minority women, nor in the minorities projects, where women subjects were not identified, were the special problems of minority women addressed. It is recommended that minority women should be given special attention and special programs should be initiated if they continue to "fall between the cracks" of existing programs (cf. Malcom, 1976).

5. Attending to continuity/institutionalization of funded efforts. Ideally, there should be no need for women's offices and programs as separate entities, e.g., these efforts should be incorporated and integrated into every level of the existing structures. Further, one specific aim of research/demonstration projects is their continuation by the institution in the absence of special funding. In order to facilitate both continuity and institutionalization

we recommend special attention to utilizing existing and ongoing structures as a basis for these activities, such as sororities of black women, professional associations, PTAs, etc. Where these are not available, the program should be cognizant of continuation problems prior to initiation, and should plan to "institutionalize" the program. One way of doing this is to make the program concretely benefit the parent institution (e.g., increased enrollment, increased visibility, legal compliance, etc.).

6. Disseminating the developed materials. Some of the projects have engaged in fruitful activities to disseminate their "products." These appear to be successful. However, since these have occurred through different outlets, a compilation of these activities might be produced by NSF. Several projects overlapped in the materials developed (e.g., Policy Studies and Kansas) and other project products (e.g., the film and media packets) could be used co-jointly in the context of other programs. A compilation of all projects designed to encourage women to choose science as a career could be an aid to science teachers and career educators to choose the material most appropriate for their classes. These materials could be made available to a variety of clearinghouses, public libraries and school libraries.

7. Investigating additional intervention strategies. We also recommend experimental investigation of several areas not covered by these projects. These are the study of the effects of aggregation, males in science establishment, and the effect of "significant others," including peer and social group pressure.

a. Systematic examination of the effects of aggregating women students. A recent article in Science (Tidball and Kistiakowsky, 1976) reported that the undergraduate institutions from which women have gone on to receive doctorates are different from the institutions preparing men for doctorates. The authors concluded that "women who subsequently received doctorates were more likely to have graduated from institutions that enroll large numbers of women students, had a long and continuous history of women graduates who attained doctorates and offered strong academic preparation in several areas of study." Since many schools enrolling women offer strong preparation in several areas, the distinguishing characteristic of these institutions preparing women for nontraditional roles appears to be their long and continuous history of female representation.

To describe the effects of grouping a certain proportion of these women, a construct might be developed involving "critical mass" or "critical proportion." The construct implies that once this number or proportion is reached, the recruitment and retention of the group becomes a self-sustaining and self-perpetuating system.

Once a critical number or given proportion of women participate in a nontraditional activity, an examination of the need for special recruiting/retention programs should be performed. In fact, it may result in an ever increasing rate of participation.

Conversely, another investigation should determine whether the absence of the critical number or percentage may produce a situation where efforts must be continuously expended to recruit and retain these groups, since the history of unsuccessful participation acts as a discouraging factor, e.g., as the retention rate drops because of a feeling of isolation, fewer will be attracted.

b. Systematic examination of attitudes of males. There is undeniably still a great deal of overt and covert discrimination against women pursuing science. The guardians of the profession are predominantly male. We recommend examination not only of the attitudes of the male science establishment toward females in these professions, but the circumstances that could occur to influence their attitudes toward the participation of women. Dr. Janet Brown, head of the Office of Opportunities in Science at AAAS, has strongly suggested that such research be conducted by an eminent male scientist.

c. Examination of the effect of significant others on women. Since the problems involved in occupational segregation are similar to normative deviance, we recommend examining the influence of:

- parents
- school personnel
- male peers
- female peers

Admittedly, a multitude of studies have attempted to examine the most important influences on female scientists. Unfortunately, most of them have been retrospective; e.g., asking women to recall what was important to them 20 years ago. This type of research has several disadvantages: perspectives change over years, especially regarding events that were not consciously considered at the time. Examination of these factors in real time would be more advantagous, and might, as in the ACT study, indicate important changes in perceptions over years. Further, several of the present experiments included these groups, but none was successful in gauging their impact on the female students. If these are successful, the long range benefits of these programs would likely be more cost-effective.

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APPENDIX A

ALTERNATIVE INTERVENTIONS

ALTERNATIVE INTERVENTIONS

There are many barriers to account for the lack of participation by women in nontraditional science careers. These psychological, sociological and institutional barriers have been systematically laid out by Dr. Smith at the University of Kansas (1976). His delineation of the barriers is given in Table 1.

There are a wide variety of interventions or treatments which may serve to overcome these barriers and to encourage women to choose science-related careers. These vary by age group, comprehensiveness and area of focus. Generally speaking, programs for young women may be considered career education and are less specific to science. Further, programs offered in earlier years may be considered as recruitment, while programs for college age may concentrate on support and retention.

Many of the potential programs listed below are not within the charter constraints of the National Science Foundation. Because it is felt that a sustained effort, reaching each female as continuously as possible throughout her formative years, may be necessary to counteract society's socialization processes, many programs are listed.

The list of programs is divided by educational level. The assumption underlying these programs is given first. The list is not complete, and is intended to act as a "working draft," and is laid out in Table 2.

A. Elementary School

There are many reasons for lack of female participation in scientific careers. A number of the reasons can be sufficiently stated in the generality that neither males nor females, whether young or mature, expect women to have careers in science. The result of this "nonexpectation" results in psychological, sociological and institutional barriers.

The psychological variables are related to sex role socialization; sex role socialization refers to the differential processes and experiences used to prepare males and females for the roles that society defines as being appropriate for their sex. This "social shaping" is conducted by the adults responsible for the child's care to deliver rewards and punishments contingent on whether the child's behavior is sex appropriate. The other means is by example: children imitate people the same sex as themselves. This begins at birth and may clearly be seen in a child's preferences for toys by age 2 (cf. Maccoby and Jacklin, 1974). There is some evidence to indicate that males become sex-typed at an earlier age than females; in fact, there may be a decline in sex typing among girls between the ages of five and ten (see Fling and Manosevite, 1972, for a review).

TABLE 1

Barriers Proposed as Affecting Career Choice of Women

Role Conflict (Career Person versus Parent)

1. Women feel a long-term commitment to a career interferes with raising preschool children.
2. Women feel a long-term commitment to a career interferes with raising a family.
3. Women feel that their basic responsibility is raising the children in our society.

Role Conflict (Career Person versus Spouse)

4. Women feel that a husband's success is more important than a wife's success.
5. Women feel they should adjust their career goals in order not to interfere with their husband's success.
6. Women are not free to move to new locations as career opportunities open in their field.
7. Women feel a strong career commitment interferes with a happy marriage.

Family's and/or Friends' Opposition to a Career

8. People who are important in a woman's life (that is, family and friends) believe a woman's place is in the home.
9. People who are important in a woman's life (that is, family and friends) do not think it is appropriate for a woman to pursue a professional career.

Lack of Opportunity (in Jobs)

10. Women who are trained in science fields do not have as many job opportunities as men.
11. Women have not been informed of job openings in traditionally male science careers.
12. Women are not as aware as men of the variety of available science careers.

Lack of Opportunity (in Education)

13. Women with math and science ability do not have the same educational opportunities as men. For example, women have more difficulty getting into medical school than men.
14. Senior high women are discouraged from pursuing the science and math courses which would prepare them to pursue science majors in college.

TABLE 1 (Continued)

Fear of Success

15. Women fear the consequences of being highly successful in their careers.
16. Women do not want jobs that involve professional responsibility and commitment.

Lack of Professional Support

17. Women scientists are out of the mainstream of important professional contacts.
18. Women who are scientists are not supported and not kept informed by fellow professionals. For example, women do not receive up-to-date information about research possibilities.

Perceived Lack of Ability

19. Women do not feel competent enough in math and science areas.
20. Women believe the stereotype that they do not have a natural bent for solving problems and therefore do not have a natural ability to be scientists.

TABLE 2

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Knowledge that science-related careers are open to women is a prerequisite for pursuing those careers	1. Use of nonsex stereotyped depicting of occupations in printed material 2. Programs to reach elementary school teachers and administrators 3. Efforts to eliminate current sex role specialization in school systems	1. Use of nonsex stereotyped depictions of occupations in printed matter and "career day" programs 2. Programs to reach high school teachers, administrators, and especially counselors 3. Efforts to eliminate current sex role specialization in the school systems	1. Workshops and seminars portraying professional women in science careers 2. Increase in number of female science professors			
Many women capable of pursuing science-related careers lower their aspirations because of peer and parent pressures and concern for popularity and future familial relationships		1. Making males and females aware of career alternatives 2. Making males and females aware of satisfying nontraditional family relationships 3. Encouraging young women to discuss career options with their parents				

TABLE 2
(Continued)

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Many women fail to pursue science-related careers because they fail to successfully complete prerequisite mathematics preparation		1. Programs emphasizing long-range planning including continuation of mathematics 2. Innovative methods of teaching math adapted to the strengths of females 3. Special tutorial programs	1. Remedial math courses 2. Innovative teaching methods 3. Special tutorial programs			
Career committed females may benefit from special counseling support group activities		1. Identification of career committed females	1. Special counseling and support groups 2. Special housing			

TABLE 2
(Continued)

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Tangible and intangible institutional barriers discourage women from pursuing science-related careers			1. Increasing number of undergraduate assistantships 2. Increase women in coop and intern programs 3. Rewriting "fellow"ship brochures 4. Increase female faculty	1. Provide more financial aid 2. Adapt financial aid provisions to meet the needs of women 3. Increase in number and status of female faculty 4. Special programs to encourage Ph.D. completion		1. Repeal of anti-nepotism rules 2. Tenure and fringe benefits for part-time employment 3. Split positions and flexible hours 4. Equalization of pay scales
Women reentering labor market have special needs					1. Programs to update previously learned skills 2. Special counseling programs 3. Assistance in job placement	

TABLE 2
(Continued)

Assumption	Elementary School Programs	High School	College	Graduate	Reentry	Post Employment
Women beginning or continuing formal education in their mature years have special needs					1. Special vocational guidance programs 2. Use of CLEP and related programs 3. Increase in assistantships 4. Increase in coop and intern programs	
Increasing the awareness of the status of women by the working community will (1) increase job satisifaction, (2) increase the number of females in the labor force, and (3) may alter the stereotypes that employees convey to their children						1. Workshop/semin of employees on t status of women 2. Soliciting ind trial support for women's programs

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Assumption: Knowledge that science-related careers are open to women is a prerequisite for pursuing those careers.

Possible Interventions.

1. Use of nonsex stereotyped depicting of occupations in printed material. One method of informing girls of the career options they might pursue is concern for the portrayal of women in textbooks, vocational material, comic books and so on. This effort should include an emphasis that most women will eventually be in the labor force, and cannot be housewives and mothers throughout their lives, even if they desire to.

2. Programs to reach elementary school teachers and administrators. A complement to careful attention to the use of written materials is the attitudes of the people interacting with the children. Conscious efforts to avoid stereotyping, either by omission or commission, should be done by the teachers. Workshops on sex stereotyping for teachers and administrators (and parents if possible) could be conducted to make them aware of their own stereotypes which they subsequently relay to the children.

3. Efforts to eliminate current sex role "specialization" in the school systems. An obvious means to decrease job/sex stereotyping is to eliminate the most visible source of stereotyping observable by children, e.g., the school system itself. This would suggest elimination of teaching as a "woman's" profession, and administration as a "man's" profession, and to increase the number of female administrators and male teachers in the school system.

B. Junior and Senior High School

Role imitation and reinforcement by parents is augmented by peer pressure in adolescent years, where fear of not being socially acceptable is frequently translated by women into not appearing brainy or taking "hard courses" like math (Levine, 1976). This may account for the drop in career commitment from junior to senior high (Matthews and Fiedeman, 1964). Late adolescence may also be a period of greater identity with stereotypically femine sex role characteristics (Long, Zellar, and Henderson, 1968). The result of sex role stereotyping may be seen in the career interests patterns, curriculum selection and other factors which will heavily influence their subsequent lives.

Assumption: Knowledge that science-related careers are open to women is a prerequisite for pursuing those careers.

Possible interventions.

1. Use of nonsex stereotyped depictions of occupations in printed matter and "career day" programs. Portrayal of both sexes doing a wide variety of jobs might not only encourage both sexes to consider a wider range of career alternatives, but may prepare the way for more pleasant on-the-job interactions for those choosing nontraditional alternatives. These career days should include exposure to women in science careers.

2. Programs to reach high school teachers, administrators and especially vocational counselors. Since the basic preparatory courses are taken in the high school years and preliminary, if not final, vocational decisions are made at that time, it is especially important for young women to be aware of the range of career options open to them. These options are conveyed to them by the adults interacting with them, e.g., their parents, teachers and counselors.

The limited vocational considerations given by young women is heavily encouraged by sextyping on the part of high school counselors. A selected annotated bibliography on career counseling (1972) cites a large number of studies documenting sextyping by vocational counselors. Therefore a special effort should be made to encourage high school counselors to consciously inform women about potential opportunities. Since many counselors may not be aware themselves of changing trends in opportunities for women, workshops (like the NSF-sponsored Michigan Tech workshop) may increase their knowledge.

3. Efforts to eliminate current sex role "specialization" in high school systems, including more female science and math teachers. Since the school system itself is the most visible "world of work" observed by the teenagers, it is important that job/sex stereotyping does not occur, e.g., a mixture of male and female teachers in all disciplines including science, and an "integrated" administration.

Assumption: Many women capable of pursuing science-related careers lower their aspirations because of peer and parent pressure, and concern for popularity and future familial relationships.

The underlying assumption is that altering the stereotypes of young males, as well as the females is an integral part of encouraging women to prepare for science-related and other nontraditionally female

careers. Since many young women are influenced by their male peers, making nontraditional careers "acceptable" to the males may result in fewer women altering their career aspirations.

Possible interventions.

1. *Making males and females aware of nontraditional career alternatives.* (See 1, p. 64)

2. *Making males and females aware of satisfying nontraditional family relationships.* A concomitant awareness for both males and females is that persons who choose nontraditional careers are not "weird" and may have satisying family/spouse relationships, since this is a high level concern for that age group. Many of the young people may only be acquainted with one alternative for family living, e.g., mother at home, father at work. Alternative family/spouse relationships and living styles could be discussed during career education, "hygiene" and related courses.

3. *Encouraging young women to discuss career options with their parents.* Most female children do not seriously discuss their career aspirations with their parents as much as most male children do. Based on the responses of the young women participating in the University of Kansas workshops, many of them felt their parents would disapprove of their plans or not take them seriously. Most reported being very pleased at the amount of support they got from their parents. Consequently, inviting parents to separate, concurrent or mixed career workshops with their children may be a very powerful tool.

4. *Identification of and special counseling for "career committed" young women.* Recent research has shown an attempt to identify nontraditional "pioneers" or career oriented women by about tenth grade in high school, and identify science vs. nonscience oriented commitments (e.g., Astin, 1968; Fortner, 1970; Masih, 1967; Mooney, 1968; Mowesian, R., Heath and Rothney, 1966; Rezler, 1967; Schissel, 1968; Wokkon, 1970; Brown, 1975; Kotcher and Gellman, 1976).

The profile of the career committed female shows that she attends a large high school, and has had career counseling by ninth grade (Astin, 1968). Girls who have high ability, especially in mathematics, choose fields that require greater commitment (Astin and Myint, 1971). They are more likely to have a father in a white collar occupation (David, 1971), and tend to identify more with their fathers (Johnson, 1970), come from upper middle class families, had better educated mothers, and approved of a variety of career roles for women (Levine, 1968). She perceives herself as capable of enduring long periods of work and has a high need for achievement (Masih, 1967). If she has high degree of career commitment, she is likely to choose an atypical occupation. She is more likely to be Jewish, live in more heavily populated areas, be the second born child (Wolkon, 1970), and have a "masculine" self perception (Kotcher and Gellman, 1976). She

is more uncertain on vocational choice if she has high ability in math and science (Sedlackel, 1968).

If, in fact, these women can be identified, special counseling and/or seminars and workshops should be available to them. The content of the workshops could include extensive information regarding professional careers and concomitant lifestyle arrangements.

Assumption: Many women fail to pursue science-related careers because they fail to successfully complete prerequisite mathematics preparation.

One of the most limiting factors for women in choosing careers may be their inadequate background in mathematics. If women have dropped mathematics from their curriculum after high school algebra, their career options are subsequently severely limited in the direction of traditionally "women's" jobs, e.g., all of the physical sciences, the natural sciences and most types of business administration are no longer open to them without remediation of their mathematical skills.

Males have always scored considerably higher on tests of mathematical ability at the college entrance levels. This does not appear to be caused by an inherent lack of ability in mathematics in females. There are no sex differences regarding numberical ability during the preschool years (Shipman, 1971); in fact, young girls appear to be ahead of the males. The majority of studies show no sex differences in mathematics up to adolescence, but when differences are found in the age range of nine to thirteen, they tend to favor boys (Maccoby and Jacklin, 1974). Further, the males score dramatically higher by their senior year in high school (Flanagan, 1961). This trend, however, is not cross-cultural, e.g., similar studies in Sweden show only a very small difference at the senior high level.

There are a variety of factors influencing the mathematical ability test scores. Males tend to take more math courses, either because they perceive that they will have a greater need for them, they received encouragement not given to girls by counselors and parents, or peer and self expectation levels. However, when the number of math courses taken in high school is equalized for males and females, males still emerged with substantially higher averages (Maccoby and Jacklin, 1974). Factor analysis of mathematical aptitude tests suggest that women do better on verbal items, while males did better on visual-spatial portions (e.g., Smith, 1964; Werdlin, 1958). Moreover, a space factor emerges as an element in mathematical skills for males but not females (Werlin, 1961). Therefore, mathematical ability is not a unitary factor, and there are different ways to attack mathematical problems, and individuals differ in the cognitive abilities they characteristically bring to bear on this problem. Maccoby and

Jacklin (1974) plead for more understanding of mathematical "styles."

Possible interventions.

1. Programs emphasizing long-range planning, including continuation of mathematics. An important concept to convey to young women is the high proportion of women who do work for some part of their lives, e.g., very few women have a stable career as a housewife and mother, or a short-term career that will be satisified by short-time career preparation, e.g., office work. Consequently, young women should plan on work, and on making those years the most satisfying and productive possible. There are at least three reasons reported by women as to why women don't complete advanced mathematics. They are: many women think that they will not need it, will not do well in it and/or do not like it. Programs emphasizing the role of work in their lives and the necessary preparation for certain careers could be given directly to the young women or workshops to increase teacher and counselor awareness could be conducted.

2. Innovative methods of teaching math adapted to the strengths of females. Many females have higher verbal scores than math scores on standardized achievement tests. Consequently, they may be more confident in solving problems in a conceptual manner. It is possible to adapt the method of teaching mathematics in order to capitalize on these strengths. For example, problems might be solved conceptually or verbally and then "translated" into mathematics. Innovative teaching methods could result in decreasing the fear and increasing the confidence and enjoyment with which many women approach mathematics.

Assumption: Courses and activities related to science may increase interest, confidence and aptitude in science careers.

Possible interventions.

1. Availability and encouragement to include other courses that would increase their interest and aptitude in science. A variety of courses may serve to increase the number of women in science-related careers by increasing their confidence in pursuing them. These courses, frequently taught at the secondary level, would include auto mechanics and shop.

2. Availability and encouragement to enter science clubs, fairs and special programs, such as those sponsored during the summer of the junior year by the National Science Foundation. Interest groups, fairs, etc. may increase the interest, or sustain the interest in science for teenage women.

C. Undergraduate or College Level

Assumption: Knowledge that science-related careers are open to women is a prerequisite for pursuing those careers.

Possible interventions.

1. Workshops and seminars portraying professional women in science careers. Several NSF-sponsored projects are implementing this approach; e.g., Mary Baldwin College was funded for seminars in 1975, and many more have been funded in 1976. These workshops might encompass three components of discussion by or with the role models. The three are: actual job content, lifestyles and on-the-job problems. Depending upon the interests of the participants, the various aspects could be differentially emphasized. For many science majors, the different job titles that may be pursued from a science major may be of the most interest. For other groups, lifestyle solutions and preparation of on-the-job problems (if any) may be of more interest.

2. Increase in the number of female science professors. Even though the majority of women having careers in science specialize in teaching, the percentage of full professors is very low in the sciences. The most obvious and most available role model for women interested in science would be their professors. In addition, it is likely that female professors may be more supportive of female undergraduate majors than male professors. Therefore, programs to increase the number and status of female professors is encouraged. The programs to increase the number may encompass all of the programs suggested in this section, and there may be many years before results are observed. Direct support of programs to increase the status of current female professors may produce results in a shorter time period. Many such programs are referenced in the section on programs for women currently in the labor force.

Assumption: Career committed females may benefit from special counseling, support group activities and other forms of social encouragement.

Possible interventions.

1. Special counseling or support groups for women planning to pursue nontraditional science careers. This special counseling or support groups may take many forms. The groups might be task oriented around special courses that would interest primarily females or be more social in nature. Whatever the vehicle used, the major aim would be to decrease the alienation and social pressure by encouraging friendships among women with similar values and aspirations.

2. Special housing for women planning to pursue nontraditional science careers. While special housing presents many difficulties at large universities, group housing has been shown to increase the retention rate of female engineering majors (see Brown, 1975). Wherever this may be an option, different housing arrangements may be tried.

Assumption: Many women fail to pursue science-related careers because they fail to successfully complete prerequisite mathematics courses.

Possible interventions.

1. Remedial mathematics courses. Offering "remedial" mathematics courses or special courses such as the UMKC project, may be an appropriate vehicle to assist women who are interested in science, but have difficulty in advanced level courses because of inadequate backgrounds in math. These are probably most successfully taught in an innovative manner.

2. Innovative methods of teaching for advanced mathematics. Even for those women successfully completing mathematics at the high school level, innovative approaches to teaching mathematics could be applied to advanced courses, such as solid geometry and calculus (see Sec. B).

3. Special tutorial programs. For women taking advanced mathematics courses in college, special tutorial programs, run by other women might assist their colleagues. The women interviewed at the University of Kansas expressed their shyness with male tutors, and reluctance to ask the teachers for help. They felt that not understanding a single lesson usually meant it was impossible to comprehend any subsequent lesson. Therefore, they wanted female tutors who were immediately available and consistent.

Assumption: Tangible and intangible institutional barriers discourage women from pursuing science-related careers.

Not only do women pursuing nontraditional careers encounter social barriers, they frequently encounter institutional barriers. Even those schools professing equal opportunity for financial aid, intern programs, etc., frequently have not adapted them to the special needs of women.

Possible interventions.

1. Increasing the number and percentage of women holding undergraduate assistantships in teaching and research in the sciences. One of the "spin-off" effects of at least one of the experimental

projects (not currently complete) appeared to be the very positive effects of the junior and senior science majors hired as staff personnel. It not only served as a financial aid, it was interpreted as a "vote of confidence" and served to increase their interest, exposure and expertise in their areas. Assistantships also provide additional encouragement to go to graduate school, and usually provide a closer relationship with a faculty member. Assistantships to declared science majors may improve the retention rate and result in more women attending graduate school in science.

2. *Increasing the number and percentage of women in science-related coop and intern programs.* One of the current NSF-sponsored projects is attempting this program. Such programs should result in a better understanding of job options, job requirements and preferable job alternatives (discovering that one doesn't like a job is as important as discovering that one does). Further, it may provide better "connections" to obtain a job or to gain admission to graduate school.

3. *Rewriting graduate "fellow"ship brochures.* One discouraging factor in applying for graduate school is the way information on financial aid is presented (Nies, 1976). The brochures, especially on the most prestigious "fellow"ships are uniformly written in masculine gender and appear to rule out women.

4. *Increasing the number and percentage of female science professors (advisors).* (See p. 68)

D. Graduate School

The National Research Council reports that the number of doctoral degrees granted to women between 1970 and 1974 was 8.4 percent of the total in math, 3.3 percent of the total in physics, 9.0 percent in chemistry, 3.7 percent in the earth sciences, and .8 percent in engineering. The percentage of female doctorates has declined when compared to the years 1920-29 in almost all instances (the percentages in the life sciences has remained relatively constant). All of these fields, however, showed a slight increase between 1973 and 1974.

The percentage of females that hold M.S. in the sciences is proportionately larger than doctorate degrees. For example, 13.4 percent of the M.A.'s in the geosciences were female and 24.5 percent in math. The percentage typically increases further in the number of undergraduate majors.

David (1971) concluded that "earning a doctorate is the factor that most equalizes the women to the men in science and engineering" (p. 222), in terms of employment, salary and contribution to their field.

However, barriers to women pursuing science occur through the educational system. It is likely that one of the most discouraging aspects of pursuing a graduate degree are the institutional barriers that preclude a family life. Therefore, the next section concentrates on institutional barriers.

Assumption: Tangible and intangible institutional barriers discourage women from pursuing science careers.

Possible interventions.

1. *Provide more financial assistantships to women in the sciences.* Discrimination in granting fellowships, which serve to increase self confidence, add to qualifications, as well as aiding financially, is common. For example, consistently less than 3 percent of NASA fellowhips go to women (about twice the rejection rate for females as males), and about 18.7 percent of NSF fellowships to women in 1972-73 (Nies, 1976).

2. *Adapting financial aid provisions to meet the needs of women.* Financial aid provisions are typically designed around the "male model," e.g., they do not have flexibility in the number of hours, scheduling and so on. Provisions for less than full course load, child care provisions, and eligibility when enrolled nonconsecutive quarters or semesters would enable more women to complete course work and laboratory requirements and encourage sustained pursuit of graduate degrees.

3. *Programs to increase the number and status of female science faculty.* One of the major determinants of degree completion may be the faculty advisor. Not only would all of the forementioned comments concerning females in faculty and administration apply, but the additional factor of understanding of problems of the female graduate student and support of her ambitions might occur more frequently with female advisors.

4. *Special programs to encourage completion of the Ph.D.* Women tend to pursue graduate education but a lower proportion receive degrees (David, 1971). If the Ph.D. is an equalizing factor in employment, salary and accomplishment, special programs to encourage completion (and to contribute to the supply of role models and female faculty members) should be conducted. These programs might include female colloquium speakers, support groups, internships, workshops and seminars.

E. Post Grad Reentry Programs

NSF has sponsored a project to update the skills of mature women who have been out of the labor market, but are graduates with majors in chemistry. The Foundation is funding many more of these projects in 1976. These programs are especially important since many women either reenter careers, start new careers, and start or continue their educations after their child bearing years.

Assumption: Women reentering or entering the labor market in their mature years have special needs.

Possible interventions.

1. *Programs to update previously learned skills.* The logic of these programs is to build on skills acquired years ago and to make them applicable to the current instruments and job market.

2. *Special counseling prior to and during entry in the labor force.* It has been argued that mature women have intense counseling needs to adapt patterns of family life and to attack confidence problems. Consequently, counseling programs might be incorporated into updating skills programs.

3. *Assistance in job placement.* Another component of reentry programs may be direct aid in job placement, including the use of intern programs.

Assumption: Women beginning or continuing formal education in their mature years have special needs.

Possible interventions.

1. *Special vocational guidance programs.* Since women in their mature years may not be as influenced by peer pressure and "fear" for their future family/spouse relationship, they may be more likely to choose science or math careers. Special programs should be conducted to make them aware of their career options.

2. *Use of CLEP and related programs.* Many women continuing their undergraduate careers may be able to exempt certain courses by using the CLEP program. Such programs might decrease time pressures in order that lab courses could be more easily completed.

3. *Increasing the number of mature women receiving graduate and undergraduate assistantships in science.* The "vote of confidence" given by such assistantships may be especially valuable to mature women, and may serve to increase their professional job entry level.

4. Increasing the number of mature women participating in coop and intern programs. Coop and intern programs may be especially valuable to more mature women, since they may be more serious about their careers than younger women, and may spend more uninterrupted years in the labor market.

F. Post Employment

According to the National Academy of Sciences 1973 report, the unemployment rate for female Ph.D.'s (at only 3.9 percent) is nevertheless more than three times that of men. However, the percentage of women in the work force decreases with a decrease in the highest educational degree.

Women are as likely as men to remain with their employer and do not change jobs more frequently, although they receive less salary than their male colleagues, even when education, experience, etc., are taken into account.

Most of these programs represent institutional barriers that make working difficult, if not impossible, during the period that children are young.

Assumption: Tangible and intangible institutional barriers discourage women from pursuing science-related careers.

Possible interventions.

1. Repeal of antinepotism rules. The result of antinepotism rules is that it is more difficult for women to get professional jobs for which they are qualified and decreases their status and numbers on university faculties. One school visited by the evaluation team actively recruited wife/husband teams. The consequence was a higher proportion of female faculty members, and a longer tenure of faculty members.

2. Tenure and fringe benefits for part-time employment. If women could accrue tenure positions while working part-time, an incentive to remain part-time in the labor market during child bearing years would be provided. The part-time employment would result in her not losing touch with her field, and make full-time reentry less difficult.

3. Split positions and flexible hours. A few innovative institutions now have "split positions" which enable a wife/husband team to share a job, or any two people to share a job. This arrangement also makes it more convenient for a woman to continue employment.

4. *Equalization of pay scales.* One obvious way of increasing women's participation in the work force is to make it more lucrative for them. Further, it is demoralizing for women to work at the same job and do the same quality of work as her male colleagues, but be paid less.

Assumption: Increasing the awareness of the status of women in the working community will (1) increase job satisfaction, (2) increase the number of females in the labor force and (3) may alter the stereotypes that the employees convey to their children.

Possible interventions.

1. *Workshop/seminars of employees on the status of female professionals.* These workshops should be aimed at decreasing the job/sex stereotyping. If sex stereotyping is ameliorated, the female employees should experience greater job satisfaction and less interpersonal friction on the job. Second, it may provide an atmosphere where men and women help younger entering women. Third, increased awareness of stereotyping behavior may result in the hiring of more female personnel. Finally, increased awareness may also alter the manner in which the employees, as parents, socialize their children.

The format of these workshop/seminars could be varied. It should be noted that the potential results, although laudable, are also ambitious, and would not likely result from a single workshop.

2. *Soliciting industrial support for women's programs.* There are many advantages to the industrial support for women's programs. First, it expands the funding base of these programs and may enable more extensive interventions. Second, it is a convincing demonstration to women that job opportunities may be open to them. It may also increase counselor and teacher awareness of job opportunities. Finally, it provides a psychological boost to project personnel to have private sector support, which has been traditionally conservative.

APPENDIX E

FILM BIBLIOGRAPHY

Title: And Who Are You?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Hubert S. Coffey and Marya Mannes discuss discovery of one's inner self and the possible conflicts in maintaining one's individuality. One of the series, Choice: Challenge for Modern Woman.

Title: Choice Chance Woman Dance
44 minutes, color, 1972
Filmmaker: Ed Emshwiller
Description: Purports to "tackle the dilemmas, paradoxes, and choices available to the middle class woman today . . ."

Title: Girls and Women
A series of 10 programs of 30 minutes each
Filmmakers: Selma Odom and Margo Shackson
Producer: The University Television Center
Description: A series which focuses on the physical and sociological differences between the sexes, the psychology of women, variations of life styles, women's place in history, stereotypes of women and women's rights.

Title: Is Personal Growth Selfish?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Sister Mary Corita, and Anne Steinmann discuss women's growth throughout life, their dependency upon male and societal attitudes, and opportunities with "the system." One of the series, Choice: Challenge for Modern Woman.

Title: Margaret Mead
30 minutes, B/W, 1960, #6930
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Celebrated anthropologist brings the experience and understanding gained from her study of primitive cultures to a lively discussion of contemporary world problems--marriage and morality, the place of women in modern life, the education of young people, etc.

Title: Woman's Place?
30 minutes, 16mm, B/W
Source: American Association of University Women/2401 Virginia Avenue, N.W./Washington, DC 20036/phone 202-338-4300
Description: AAUW panel discussion by six women on the status of women.

Title: A Woman's Place
A weekly program series on WTTW Ch. 11. Production started in February 1972, and broadcasting began shortly thereafter.
Description: Focuses on the changing role of women in today's world. The program is designed as an open forum for the exploration and discussion of the full spectrum of viewpoints concerning women's issues.

Title: 51%
30 minutes, 16mm, color, 1971
Directed by Dick Feldmen, produced by Rob't Drucker & Co.
Source: Sheldon Satin Films/1175 York Avenue/New York City, NY 10021
Description: Three case studies of women employees in a corporation spotlight stereotypes about and discrimination against women. Provides good role-model examples for women dealing with difficult situations.

*Title: Help Wanted - Women Need Apply
61 slides with script
Source: Jim Farron/Dallas Regional Office/Civil Service Commission/ Dallas, TX
Description: Designed to be shown to high school and college classes and women's clubs, the film describes and shows women in a variety of jobs--flood control engineer, attorney, chemist, accountant, radio equipment installer and repairer, photographer, and others.

Title: Job Interview - Three Young Women
17 minutes, B/W, 1968
Source: Business Education Films/5113 16th Avenue/Brooklyn, NY 11204
Description: Three young women are interviewed for a job. The discussion centers on mistakes they make during the interview for a job, and how to correct them.

Title: Never Underestimate the Power of a Woman
20 minutes
Source: Norma Briggs/Department of Apprenticeship Training/ 310 Price Place/Department of Labor, Industry and Human Relations/ Madison, WI
Description: A film showing women performing well in so-called male occupations.

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*Films dealing specifically with women in science.

Title: Modern Women: The Uneasy Life
55 minutes, 16mm, B/W, 1965
Source: University of Indiana
Description: Faces with candor--the feelings of both women and men regarding the traditional role of women. The new freedom involves multiple choices which create anxieties. Participants include young married women, college women, career women.

Title: What Is A Woman?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Keith Berwick and Margaret Mead discuss what is feminine and masculine, as prescribed by society and confused by changing patterns. One of the series, Choice: Challenge for Modern Woman.

Title: What Is The Shape Of Tomorrow?
30 minutes, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Jeanne Noble and Rabbi Alfred Gottschalk discuss variation in personal standards, beliefs, and values; spiritual, moral and interpersonal sources of strength; and women's power in shaping the world of tomorrow. One of the series, Choice: Challenge for Modern Woman.

Title: Who Wants Freedom?
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Elisabeth Mann Borgese and Richard Lichtman discuss the meaning and consequence of "freedom" . . . how much self-determination and in what areas of life? One of the series, Choice: Challenge for Modern Woman.

Title: Woman Is
27 minutes, color, 1969
Producer and Source: American Standard Association/10 E. 40th Street/ New York City, NY 10016
Description: Examines the personal philosophy of the woman in today's world and shows her in some of her many roles, as an enigma, a philosopher and a romantic.

*Title: . . . keep the door open
19 minutes, 16mm, color
Filmmaker: Charles E. Cockelreas
Source: Motion Picture Production Division-3153/Sandia Laboratories/ Box 5800/Albuquerque, NM 87115
Description: Film designed to encourage young women to "keep the door open" on career options and to consider non-traditional careers, especially math and science. Discussions of life and work with numerous professional women involved in non-traditional careers.

Title: New Careers for Women
17 minutes, color
Source: American Educational Films/331 North Maple Drive/ Beverly Hills, CA 90210
Description: Restructuring of the roles between the sexes will be illustrated in a discussion of the new family and the role which the creative working woman will have in the world of the future.

Title: Wages of Work
30 minutes, 16mm, B/W
Source: University of California/Extension Media Center/Berkeley, CA 947.0
Description: Mary Keyserling and a panel of employment experts discuss why, how, when, and where women work, and effects on family, job, and community. One of the series, Choice: Challenge for Modern Woman.

Title: What's The Matter With Alice?
30 minutes, 16mm, color, 1972
Source: Newsfilms, USA/21 West 46th Street/New York City, NY
Description: Prepared for the Civil Service Commission, the film communicates an understanding of "upward mobility."

Title: The X-Factor: Women As People
30 minutes each (one inch video-tape)
Source: Cornell University/Director ETV Center/Van Rensselaer Hall/ Ithaca, NY 14850
Description: Two half-hour programs on the status and image of women, developed for a course at Cornell.

Title: Childcare: People's Liberation
20 minutes, 16mm
Source: San Francisco Newsreel/Department W/1232 Market Street/ Room 101/San Francisco, CA 94102
Description: This film reviews how mothers and children in this society tie each other down. It shows, through examples, how community-run childcare centers are a step toward liberation.

Title: Who is Sylvia?
27 minutes, B/W, 1957, #4793
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Study of the dreams, fears and hopes of a 14 year old girl, "half child, half woman" and of her relationships with her family, school and friends.

Title: Teach Your Children Well
30 minutes, 16mm, color
Producer: Marta Ashley; Assoc. producer: Nina Jan vsky; Assistant: Marty Coe
Source: Femedia/2286 Great Highway/San Francisco, CA 94116
Description: Documentary about three women: a Black, a Chicana, and a white woman in a comparison of how their parents educated them and how the consequences of this affects them today.

Title: Choice: Challenge for Modern Women
series of 12 films each 30 minutes, B/W, 16mm, 1967
Source: University of California/Extension Media Center/Berkeley, CA 94720
Description: Twelve discussion programs designed to help women arrive at reasoned choices as they make decisions affecting themselves, their families, and society.

Title: Anything You Want To Be
8 minutes, 16mm, B/W
Filmmaker: Liane Brandon
Source: New Day Films/267 West 25th Street/New York City, NY 10001
Description: The conflicts and absurdities that beset a high school girl. She mimics female stereotypes: the wordly sophisticate, the wholesome homemaker, the sexy "chick," the sweet young thing. The film raises questions and provokes thought rather than prescribing answers.

Title: Evolving Toward Woman
60 minutes
Source: Contact Deidre Walsh, c/o The Feminist Voice for more information
Producer: Deidre Walsh
Description: The struggle of women to redefine themselves in the midst of the changes that are happening in our culture. It presents an introduction to the issues, rather than narrowing in on one specific issue. It includes rap sessions, interviews, and scenes of everyday occurrences.

Title: Growing Up Female: As Six Become One
60 minutes, 16mm, B/W
Filmmakers: Julia Reichert & James Klein
Source: New Day Films/267 West 25th Street/New York City, NY 10001; or from San Francisco Newsreel/Department W/1232 Market Street/Room 101/San Francisco, CA 94102
Description: A documentary on the socialization of women in America. The film traces this process through the lives of six females; the youngest is 4, the oldest is 35. In between, the women are students and workers, white and black. A powerful film.

Title: Woman, Wife Or What
29 minutes, 16mm, B/W
Producer and Source: KUON-TV Univ. Ed. TV Station/1600 R Street/ Lincoln, NE 68508
Description: Explains that in a modern world, many modern women have feelings of being trapped, their role confused. Describes the battle for intellectual recognition and need for creative achievement.

*Title: To Be A Woman
13 minutes, 16mm, color
Source: Billy Budd Films/235 East 57th Street/New York City, NY 10022
Description: Designed as a tool to trigger re-thinking and start discussion. Girls and young women were interviewed and 18 hours of feminine voices speaking of themselves, their self-image, their attitudes, their conviction, and themselves were collected. The best statements were put into 6 sections: girlhood, personhood, feminity, anti-stereotypes, sexuality and idealism.

*Title: Women's Work: Engineering
26 minutes
Source: Massachusetts Institute of Technology/Center for Advanced Engineering Study/Cambridge, Massachusetts
Description: Designed for use by secondary school students in science, math, social studies, and career education classes. The film is intended to provide in-depth portraits of women students and professionals, giving their personal views about the opportunities, problems, and rewards of an engineering career.

*Title: Women in Science
Source: Queensborough Community College/Bayside, New York 11364
Description: This is a multimedia package containing cassette interviews, slides and articles plus references, showing the work and lifestyles of six successful contemporary female scientists. Designed for use by young women making educational and career choices.

Title: A World for Women in Engineering
Filmmaker: Bell Telephone
Source: Bell Telephone Companies/Available Fall 1976
Description: A film designed to encourage young women to consider engineering as a career. Six women engineers from Bell Labs talk about their experiences in engineering.

We understand that a number of promotional films dealing with women in science are being produced privately by various companies, including General Electric and Kodak; however, we have been unsuccessful in our attempts to locate these films, or their titles.

*Title: . . .How Many Eves
14 minutes
Filmmaker: Zelda Zeldin
Source: Women's Media Workshop
Description: A film about a woman's long, but successful, struggle to secure a promotion to the next job up the ladder, for which she is clearly the most qualified. The film illustrates the problems she encounters with a manager who thinks women should be kept in their place, her co-workers (both men and women), and her husband. The film is intended for corporations, educational institutions, and counseling and management consulting organizations. The film was produced in cooperation with the U.S. Civil Service Commission.

APPENDIX F

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Woman-Power Project. New York Woman's Directory. New York: Workman Publishing Co., 1973.

APPENDIX G

SELECTED ANNOTATED BIBLIOGRAPHY

American Association of University Women Educational Foundation. Counseling Techniques for Mature Women. Washington, D.C., author, 1966. 290 p.

Report of a pilot adult counselor program, directed by Eleanor F. Dolan under contract with the Office of Manpower, U.S. Department of Labor. The consultants and participants in this program became convinced that counselors must have knowledge of adult women's psychology, information about the educational resources available, knowledge of the techniques of counseling, and information about the current job market. Women returning to work are insecure, unable to "piece together" help. They need a relationship with one person who can help them work out the basic steps. A full report, with an appendix of 158 pages containing suggested readings, syllabi, course outlines, and case histories.

An Imperative for the Seventies: Releasing Creative Womanpower: A Guide for Counselors of Mature Women. University of Missouri--St. Louis, Extension Division, 1969. 31 p.

Proceedings of a summer workshop sponsored by the University of Missouri--St. Louis, Lindenwood College and the National Association of Women Deans and Counselors. The purpose of the workshop was the exploration of the societal attitudes and emerging options for the education and employment of women in the seventies. Papers by Esther Westervelt, Gladys Harbeson, Carole Leland and Ruth Van Doren are included. A schematic cycle of the educational process for identifying, planning, implementing and evaluating programs for women, and delineation of potential target populations of women by King M. Wientge is also included.

Astin, Helen S. and Thelma Myint. "Career Development of Young Women During the Post-High School Years." Journal of Counseling Psychology, v. 18, no. 4, July 1971, p. 369-394.

This study of 5,378 women during the five year period after high school demonstrates that a certain amount of career predictability is possible. Girls who in high school score high on scholastic aptitude, especially in mathematics and who plan to go to college, usually choose fields that require greater career commitment. Plans to do office work or to be a housewife are made by girls with less aptitude and fewer academic interests. Girls who are interested in social service or health fields, but have little interest in further education usually continue to choose these fields. Full-time employment after high school, and early interest in business and management, a B.A. degree, and unmarried status proved to be the best predictors of plans to pursue a business career.

Despite the fact that close to one-half of the women studied changed their career plans during the period studied, early pattern

and interests predict later career outcomes. Since many women must decide at high school graduation about future careers, counselors and educators should assume responsibility for guiding these young women to make plans most appropriate for them, especially those planning careers that require specialized training. Guidance becomes even more crucial for those girls of high ability and low aspirations who later learn that office work or being a housewife is not commensurate with their interests or abilities.

Bank, Ira M. "Children Explore Careerland through Vocational Role-Models." Vocational Guidance Quarterly, v. 17, no. 4, June 1969, p. 284-289.

The author feels that boys and girls in elementary schools are in need of experiences which can provide maximal opportunity for vocational inquiry. A broader base for vocational choice can be developed during those formative years and counselors can help build an expanded "career-land" in which the children are exposed to the world of work and workers at an early age. The individual's choice of alternatives in his future years may be enhanced by this exposure. The author describes a role-model program which was used in an elementary school and evaluates it.

Cook, Barbara. "Roles, Labels, Stereotypes: A Counselor's Challenge." Journal of the National Association of Women Deans and Counselors, v. 34, no. 3, Spring 1971, p. 99-105.

The author discusses answers to the questions: what should it mean to a counselor to have an increased awareness of culturally defined roles for men and women? How may a counselor increase her own awareness? How does a counselor's self concept affect her ability to help individual women find answers to their individual problems?

Daly, Edith M. A Theory for the Vocational Counseling of Women. Doctoral Dissertation, Ohio University, 1970. 199 p. (University Microfilm Publications No. 71-16, 483)

A study designed to develop a conceptual framework for viewing the complexities of female occupational choice and suggesting a vocational counseling process. Literature of the past ten years was reviewed. It appears, says the author, that objective knowledge of individual traits and/or of factors operative in job situations does not explain women's vocational choice processes. Research findings seem to point to what could be called a "situational" view of women's choices. The decisions women make about career patterns and specific occupations are made in the light of their own individual priorities, at a particular point in time, in relation to their perception of the meaning of a number of variables impinging upon and within them. The author discusses her theory for counseling.

Entine, Alan D. "At Mid-Life They Return to College and Change Careers." Journal of College Placement, v. 27, no. 4, April-May 1967, p. 50-57.

The director of the pilot New Careers Program at Columbia University discusses the program, and the motivations of people wishing to change careers at mid-life. He feels that the national interest in this program has "uncovered a finding broader than the original scope of the program--countless men and women wish to change their careers in the middle years."

Eyde, Lorraine. "Eliminating Barriers to Career Development of Women." Personnel and Guidance Journal, v. 49, no. 1, Sept. 1970, p. 24-28.

Women and girls need special assistance in planning careers, and vocational counselors need to consider carefully factors in their background and patterns of development, according to author. The needs of low income group women, for example, are different from those of other groups. Counseling young girls requires covering far more than traditional topics of vocational interest and aptitudes. Counselors as a whole, the author states, have been found to hold sex-stereotypes, and they need to change these attitudes. They also need to be aware of subtle changes occurring in occupations so that they can prepare women for the future instead of the past.

Fagin, Margaret C. "Analysis of the Performance of Adult Women in Missouri on Three General Examinations of the College Level Examination Program." Adult Education Journal, v. 21, no. 3, Spring 1971, p. 148-165.

One of the major purposes of the College Level Examination Program is to give adults an opportunity to secure college credit by examination. In 1967-68, three of the General Examinations of the College Level Examination were administered to 319 Missouri women, aged 25 to 73, for the purpose of comparing their test performances with those of regularly enrolled freshman and sophomore college women, and of developing normative data for adult women. Among the 10 findings listed: chronological age has no bearing on the ability of mature women to perform well on the three examinations used; recency of formal education is significantly related only to performance on the Natural Sciences Examination; level of formal education is significantly related to all three examinations. These and other findings have important implications for counselors of adults, college admissions officers and employers of mature women.

Farmer, Helen S. and Martin J. Bohn, Jr. "Home-Career Conflict Reduction and the Level of Career Interest in Women." Journal of Counseling Psychology, v. 17, no. 3, May 1970, p. 228-232.

Many women experience conflict between home and career because of the cultural lag between social opportunity and social sanction. This study was an attempt to reduce home-career conflict experimentally,

by providing a measure of social sanction for demanding career roles and to measure the effect of this reduction on home and career interests. In addition, the study controlled for married/single status to determine its relevance to vocational interest when home-career conflict was reduced. It was concluded that the level of vocational interest in women, irrespective of married/single status would be raised if home-career conflict were reduced. Women's attitudes toward careers can be affected and counselors must take time to discuss some of the issues involved in the vocational choice process for women. Such clarification could be built into high school and college curricula for girls, "warranted when one considers the gain to society if women chose careers commensurate with their potential."

Fortner, Mildred L. "Vocational Choices of High School Girls: Can They Be Predicted?" Vocational Guidance Quarterly, v. 18, no. 3, March 1970, p. 203-206.

Although counselors are becoming aware of the changing patterns in labor force participation of women and the need to help girls prepare for the future, they have difficulty doing this because of lack of knowledge of factors contributing to the vocational choice of girls. This study attempts to identify some of these factors, using IQ scores, Sims Occupational Rating scale, social class and family wage earners' occupations, on a group of 400 high school juniors and seniors in Missouri and Wyoming. Results show predictions can be made.

Friedersdorf, Nancy Wheeler. A Comparative Study of Counselor Attitudes Toward the Further Educational and Vocational Plans of High School Girls. Doctoral dissertation, Purdue University, 1969. 171 p. (University Microfilm Publications no. 70-3887)

An attempt to determine the attitudes of counselors toward the educational and vocational goals of high school girls, and the extent of difference between male and female counselors. The counselors were compared in a role-playing situation where they acted as college bound high school girls and non-college bound girls. The counselors were also given the Strong Vocational Interest Blank and Personal Information Forms to complete. Some conclusions: male counselors associated college bound girls with traditional feminine occupations at semi-skilled levels, and tended to think of women in feminine roles; female counselors tended to expand the traditional image of female work roles; male counselors perceived the college bound girl as having positive attitudes toward traditionally feminine occupations regardless of the classification level of the occupation. Such perceptions may affect the higher educational and vocational goals of the female student. Recommendations and suggestions for public school programs to expand occupational horizons for women are presented.

Gardner, Joann. "Sexist Counseling Must Stop." Personnel and Guidance Journal, v. 49, no. 9, May 1971, p. 705-714.

The author states "Today, it is probably not a serious misrepresentation to say that all counselors are sexist." The myths about women need to be eliminated and texts and curricula from prereading on need revision so that children will develop aspirations according to their individual characteristics rather than to their sex. She suggests that counselors must take courses taught by feminists, participate in consciousness-raising groups, and pursue internships supervised by feminists.

Hall, Guin. "A New Look at Women and Vocations." American Vocational Journal, v. 39, no. 4, April 1964, p. 25.

The author contends that education has a responsibility to the girl in school and to the women wishing to re-enter the job market. Vocational schools might explore job orientation courses and women's organizations might sponsor job clinics where free guidance by career specialists could be given. There is also a need for educators, especially vocational teachers, to meet more frequently with business and industry personnel, and employment agency personnel.

Johnson, Ray W. "Parental Identification and Vocational Interests of College Women." Measurement and Evaluation in Guidance, v. 3, no. 3, Fall 1970, p. 147-151.

The subjects in this study were tested for occupational interests and identification with mother or father. From the results it would seem that women with interests in areas that are basically scientific tend to identify more with their fathers than their mothers. The results further suggest that identification with the mother, as measured by the technique of this study, is not a major consideration in the formation of the sex-typical occupational interests. Career interests are not necessarily associated with masculine identification but mathematical-scientific interests may be so associated.

Levine, Adeline Gordon. Marital and Occupational Plans of Women in Professional Schools: Law, Medicine, Nursing, Teaching. Doctoral dissertation, Yale University, 1968. 139 p. (University Microfilm Publications no. 69-13, 353)

Social class, background factors, future plans and current experiences of students at four professional schools were studied. Two of the schools (law, medicine) were characterized as masculine fields, the other two as feminine. It was found that women in the masculine field schools came from higher social class backgrounds, and had mothers who were better educated and approved of a variety of career roles for women. These findings were interpreted as showing that not only the financial resources to implement career choices, but models of orientation toward female occupational and educational roles differed between career field groups.

Lewis, Edwin C. Developing Women's Potential. Ames, Iowa, Iowa State University, 1968. 389 p.

A survey of existing research on women, including ability, education, employment, careers and guidance. The author summarizes the research which is frequently conflicting. An extensive bibliography is included.

McHugh, William Thomas. A Study of the Differences in Self-Concept and Occupational Role Concepts of Young Women and Middle-Aged Women In Occupational Training Programs. Doctoral dissertation, University of Oregon, 1970. 96 p. (University Microfilm Publications no. 71-1333)

The theory that an individual uses her occupational choice as a means of self-actualization was the position of this study. The study investigates the effects of age on the relationships between self-concept and occupational role concepts. The analyses of data in all areas of the study revealed no significant differences between the middle-aged women and younger women of this study, who were in the final stages of professional and semi-professional training at an urban community college. If, however, the directional pattern of the differences in mean scores are not due to chance, then some conclusions can be proposed. The author discusses these.

MacPherson, Lucille I. The Effects of Social Class on Females' Perceptions of Traditional Sex Role Adherence in Occupations. Doctoral Dissertation, Arizona State University, 1971. 82 p. (University Microfilm Publications no. 71-5981)

The premise of this thesis is that social class membership influences perceptions of traditional sex-role adherence in occupations and these perceptions in turn affect occupational choice. The analysis revealed significant differences between the responses of the high school seniors in three social classes for semi-professional, managerial, skilled, and semi-skilled occupations. Sex role adherence appeared to be a function of social class membership. To the extent that this population studied is representative of female high school seniors, it can be concluded that social class is an important factor influencing perceptions of sex role stereotypes in occupations. These findings help toward a better understanding of some factors involved in girls' occupational decision making and subsequent development of a theory of vocational choice for women.

Masih, Lalit K. "Career Saliency and Its Relation to Certain Needs, Interests, and Job Values." Personnel and Guidance Journal, v. 45, no. 7, March 1967, p. 653-658.

The high career-salient woman, according to this study, shows a high need for achievement and perceives herself as capable of enduring long periods of work. She indicates a strong desire for fame but is less concerned with prestige. However, this is a small portion of

the women tested and compared to men, a much smaller proportion. According to the author "the recognition of these differences is essential for any successful counseling program . . . a program more oriented toward nonoccupational interests and motivations might go a long way in clarifying the goals of women."

Matthews, Esther and David V. Tiedeman. "Attitudes Toward Career and Marriage and the Development of Life Style in Young Women." Journal of Counseling Psychology, v. 11, no. 4, Winter 1964, p. 375-384.

A study of 1237 girls, representing the developmental stages of early adolescence, adolescence and young adulthood and their attitudes toward career and marriage. One interesting finding is the drop in career commitment from junior to senior high school. The high school group showed a greater acceptance of marriage. The authors feel that a major theme which appeared in the responses is that women feel that men take a dim view of the expression of women's intelligence, and it is therefore wise to accept this situation if one wishes to marry.

Mooney, Robert Francis. A Multiple Discriminant Analysis of the Interest Patterns of High School Girls. Doctoral dissertation, Boston College, 1968. 147 p. (University Microfilm Publications no. 69-12, 329)

This study attempted to discover if significant differences exist among college preparatory high school girls categorized into broad occupational preference groups. It also attempted to examine the nature of any differences and classify girls into occupational preference groups on the basis of these differences. Results showed that the interest patterns of many high school girls seem to crystallize by the time they enter 10th grade. It further showed, according to the author, that it was possible to classify girls, on the basis of their interest pattern into more specific occupational groups than science or non-science. The classification procedures of this study might suggest to the guidance counselor a new and effective method for helping high school girls to select appropriate careers.

Mowesian, Richard. "Educational and Career Aspirations of High School Females." Journal of the National Association of Women Deans and Counselors, v. 35, no. 2, Winter 1972, p. 65-70.

According to the author, this study implies that girls are not satisfied to enter the labor market in just any job but have definite post high school objectives as well as levels of occupational aspirations. If the data from this investigation of girls in Texas can be accepted as representational of our adolescent female population, then there are some implications that counselors will need to consider in career planning with the girls. The author lists and briefly discusses four considerations.

New Patterns of Employment. Proceedings of the Conference-Workshop, March 29, 1966, Center for Continuing Education of Women. Ann Arbor, Mich., University of Michigan, 1966. 143 p.

Many women wish to resume their interrupted formal education, or enter new fields, but they want to be trained in a field where their services will be needed. The emphasis of this conference is to discover the most promising fields of employment for the educated mature women who want to work only a twenty to thirty hour week because of family responsibilities.

Ohlsen, Merle M. "Vocational Counseling for Girls and Women." Vocational Guidance Quarterly, v. 17, no. 2, Dec. 1968, p. 124-127.

Because society's influence has not encouraged girls to take seriously the choice of an out-of-home career, the author feels that the counselor must make special efforts to cope with the sex role problems and encourage girls to enter responsible positions in business, industry and the professions.

Okun, Barbara F. "Later Careers of Women College Graduates." Journal of the National Association of Women Deans and Counselors. v. 35, no. 2, Winter 1972, p. 83-89.

Increasingly, counselors are having to deal with the problems of the extended work life of the mature woman. If more were known about the potential influences--early work, education, familial experiences--counselors would be better able to help college girls identify the kind of variables they should consider during their forthcoming career and homemaking periods. Counselors would then have a better understanding of the special considerations necessary in the study of women's occupational choices. The purpose of this study was to identify the factors that determine the occupational choices of a married women 12 to 20 years after college graduation following a period of at least seven years as a homemaker.

Rezler, Agnes G. "Characteristics of High School Girls Choosing Traditional or Pioneer Vocations." Personnel and Guidance Journal, v. 45, no. 7, March 1967, p. 659-665.

Junior and senior girls in a Catholic girls' high school in the mid-west were the subjects of this study. The characteristics of girls who wished to be pioneers, i.e., physicians, mathematicians, scientists, were compared with traditionals, i.e., nurses, elementary school teachers. Academic aptitude, interest, achievement and personality differentiated pioneers from traditional. From the results it seems clear to the author that prospective pioneers can be separated from traditionals by the time of the junior year in high school. The implications of this for counseling high school girls is discussed.

Schissel, Robert F. "Development of a Career-Orientation Scale for Women." Journal of Counseling Psychology, v. 15, no. 3, May 1968, p. 257-262.

This study developed a Career-Orientation Scale which discriminates between career and non-career oriented women on the basis of interest. The results were favorable to the hypothesis that areas of interest of women classified as "career oriented" differed significantly from those of "non-career oriented" women. There is evidence that women can be ordered along a continuum of career orientations on the basis of their interests.

Sedlacek, Caroline Gladys. Selected Factors Affecting Certainty and Persistence of Vocational Choice for College Women. Doctoral dissertation, University of North Dakota, 1968. 123 p. (University Microfilm Publications no. 69-8567)

The purpose of the study was to investigate vocational choice and persistency in relation to the college factors: type of vocational choice, vocational interest patterns, personality needs, academic ability and performance, and family background. The study was done in two steps with follow-up questionnaires. Some findings for the first part: more women from the "very certain" vocational choice and "fairly certain" groups chose traditional vocations than the "uncertain" group; the "very certain" group scored lower than the other groups on the mathematics and natural science tests. Findings of the second part revealed that by the end of the second year in college 90 percent of the women were preparing for traditional feminine vocations. Women who had been "certain" or "fairly certain" of their freshman vocational choice tended to change their vocational choice.

Stafford, Rita Lynne. "A Study of the Process of Vocational Development in Professional Women." Journal of the National Association of Women Deans and Counselors, v. 30, no. 4, Summer 1967, p. 190-192.

This study of outstanding women in New York State who had been practicing in the fields of law, medicine, dentistry, nursing and educational administration, showed that with the exception of educational administration, approximately one-fifth of the respondents "knew" prior to the age of 12 that they wanted to enter the field in which they are presently engaged. By the time they had entered college, 26 percent of the attorneys knew law was their chosen profession, 45 percent of the doctors had decided on medicine, 17 percent of the educational administrators had chosen the educational world and 19 percent of the nursing administrators had made their decisions. These results, in conjunction with tables reveal that influential persons, attitudes, and events combined with data concerning youthful career interests should cause educational institutions to re-examine their patterns of student guidance.

Steinmann, Anne. "Female Role Perception as a Factor in Counseling." Journal of the National Association of Women Deans and Counselors, v. 34, no. 1, Fall 1970, p. 27-33.

The author, who has conducted many studies on sex role concepts, states, "Irrespective of age, marital status, race, education or socio-economic status, women seem to be ambivalent with respect to home and career." Counselors must now identify this problem of girls at an early age to help them make appropriate choices in resolving it. Since counseling is now more than curricular advice and since role conflict is so prevalent, the need for early counseling in school is especially urgent. Without such help, "women are likely to experience frustration in whatever role they choose." The present study is an attempt to uncover the bases for the role-conflict by investigating a group of college women. Evidence suggests strongly that counselors must consider the potential life-style of young women clients against the background of the views and life-styles of their parents. Parents' attitudes represent both a direction and a limitation for young women. Every young woman must be helped to make an early start in assessing her own needs and measuring these needs in relation to the environment. In addition, all concerned with the need to help young women plan must continually stress the need for universal free day care. "Ultimately only this will give women the opportunity to choose freely between home and career."

Tennyson, W. Wesley, Thomas A. Soldahl, and Charlotte Mueller. The Teacher's Role in Career Development. Washington, D.C., National Vocational Guidance Association, 1965. 107 p.

Revised edition of a Minnesota Department of Education publication. According to the authors, an effective guidance program is dependent to a considerable extent on the active participation of classroom teachers. Teachers can make an important contribution in pointing out the relationship of the subjects they teach to various careers. The focus of this publication is on the methods and media for relating subject matter to vocational development.

Thomas, Arthur S. and Norman R. Stewart. "Counselor Response to Female Clients with Deviate and Conforming Goals." Journal of Counseling Psychology, v. 18, no. 4, July 1971, p. 352-357.

Counselors, along with women, are struggling with the discrepancies between stereotypes of the past and the current societal changes. This study was designed to test the response of secondary school counselors to girls who select traditional occupations and those who select what are considered masculine goals (deviate). Sixty-four counselors were tested. Results were: Female counselors were more accepting of both types of girls than male counselors; counselors, regardless of sex, rated conforming goals as more appropriate than deviating goals; counselors, regardless of sex, rated girls with deviate career goals to be more in need of counseling than those with conforming goals. Details of the study and implications are discussed.